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ENGINEERING NEWS.

THE WASHINGTON AQUEDUCT has been placed in the hands of Lieut.-Col. George H. ELLIOT, U. S. Engineer, late in charge at Newport, R. I. Lieut.-Col. ELLIOT relieves Col. JOHN M. WILSON of all duties connected with the aqueduct extension of the water supply of Washington. But Col. WILSON is still Commissioner of Public Buildings and Grounds for the time being, though rumor has it that he is soon to be appointed Superintendent of the Academy at West Point. Lieut.-Col. ELLIOT is the senior officer in his grade and has the reputation of being one of the best and most experienced officers in the engineer corps.

IMMIGRATION for the quarter ending March 31, 1889, as per last report of the Chief of the Bureau of Statistics, shows a total of 54,699. In the corresponding quarter of 1888, 71,512 immigrants landed at our ports, consequently the decrease is a very considerable one. The falling-off was principally in males between the ages of 15 and 40; 12,500 less of these came here than in 1888, due most probably, to the decreased activity in public works in 1889. The number of females arriving in the first quarter of 1889 was 10,611, or only 2,600 less than in the corresponding quarter of 1888; and the number of children was 9,475, or only about 1,500 less than in the previous year. The number of immigrants over 40 years of age was almost exactly the same, or 6,307 in 1889 and 6,345 in 1888. As to nationality, in the males between 15 and 40, Germany comes first with 5,856 men, England next with 4,738, and Ireland 2,246; Austria-Hungary and Poland sent us 4,170 men, more than one-half coming from Bohemia. Italy only supplied 1,742 men of the age given as against 1,872 for Spain and 1,581 for Switzerland. Scotland furnished 1,097 men and France only 531. The remainder are from all over the world.

THE MERCHANTS' BRIDGE, says the St. Louis *Globe-Democrat*, is progressing towards the completion of its substructure. The eastern pier is very near its final resting place on the rock, though delay has been occasioned here by uneven rock and unexpected logs. The west pier is down, but the two mid-river piers have yet to be towed out and sunk.

THE PHILADELPHIA & READING R. R. in Philadelphia, claims a right to build its elevated structure to a terminal at 12th and Market St. under its charter, and last week orders were issued to commence work. But the city still refuses permits to cross the streets on the line and there the matter will probably hang until the September meeting of Councils. The company, on its part, has evidently grown weary of waiting the action of the apparently inimical city authorities and intends to build what it can under the ordinary building laws of the city, and thus push the fight for the street crossings to some definite issue. Their permits call for the building of "stone walls," from 120 to 60 ft. apart, on ground owned or controlled by the railway company.

QUICK REPAIR WORK was accomplished by the officials of the New York Central R. R. in temporarily bridging the space left by a bridge destroyed at Fonda, N. Y., by the flood of Tuesday night. Commencing on Wednesday morning, the north freight track was ready for use by 7 P. M. of the same day, and at 11.30 Thursday morning the other freight track was open; two hours later one of the passenger tracks was in place, and on Thursday evening all four tracks were again being operated.

SURVEYS for a big irrigation dam across the Rio Grande river, 3 miles above El Paso, Tex., have just been started, with W. W. FOLLETT, of the United States Geological Survey, in charge. It is said that the dam will back up the water for 15 miles, to a width of from 4 to 6 miles.

THE NEW YORK STATE CANAL BOARD has approved the plans of the State Engineer for lengthening the canal locks, as provided for by the appropriation of $600,000 made by the last Legislature.

AN INSPECTION OF THE DAMS on the Rockaway river, near Dover, N. J., has been ordered by the Common Council of Dover. It is stated that on Jan. 8, 1841, every dam on this river gave way, being pushed out by the breaking up of heavy ice. Dover was flooded at the time. One of the dams has not been repaired since it was rebuilt in 1841. It is of timber and built high.

SOME CEDAR LOGS 12 ins. in diameter, with 2-in. bore, probably laid in New York early in this century for water supply, were recently dug up at Peck Slip and South St. With few exceptions they showed but little decay.

THE CUMBERLAND RIVER is to be surveyed by U. S. Engineers, from Nashville to the Ohio, with a view to determine the cost of a complete system of locks and dams. Maj. C. A. LOCKE, U. S. Engs., is in charge.

THE MOST SERIOUS RAILWAY ACCIDENT of the week was the derailment, on July 12, of a passenger train on the Litchfield, Carrollton & Western Railway, near Greenfield, Ill. An axle on the tender broke, and the tender, baggage car, and passenger car were derailed, the latter turning over on its side. One passenger was killed and several were slightly injured.——Another serious accident was the wreck of a mixed train, July 17, on the Cairo & Vincennes Railway near Mt. Carmel, Ill. The train consisted of a loaded freight car, baggage car and two passenger cars; the freight car jumped the track, and the other cars were derailed and went down a 10 ft. bank. About 15 persons were injured.——On July 18, Master Mechanic STONE, of the Western New York & Pennsylvania Railway, was trying the speed of a new engine, when it collided with a freight train. Both engines and several cars were wrecked and one man was killed. This accident serves to show the necessity of greater care in the running of trains; it would seem as if the freight must have been an extra, or else that this light engine should not have been on the track. In any case the accident was probably the result of carelessness on the part of some one.

BRIDGE ACCIDENTS are reported as follows: Near Bridport, Vt., 2 or 3 bridges have been washed away.——Near Johnstown, N. Y., the floods of July 9 wrecked several bridges, including 7 or 8 bridges on the Fonda, Johnstown & Gloversville Ry., and the stone bridges at State St. and Stone St. Bridges at Amsterdam were also washed out.——The storm of July 15, in Pennsylvania, caused floods which carried away several bridges in Lancaster Co. The bridge at Coalbrookdale, Pa., was washed out. The temporary iron bridge over the Juniata river at Williamsburg, Pa., was destroyed by a flood July 3.——Several bridges over Herring's run, near Baltimore, Md., were washed out July 13.——In Virginia, 1 railway bridge and several county bridges near Richmond have been washed out. A bridge on the Richmond & Danville at Lexington, N. C., has also been carried away.——A wooden bridge over Taylor creek, near St. Charles, Mo., gave way recently under a team; it is stated that a number of the wooden county bridges are unsafe and should be replaced by iron structures.——The draw of the Mason St. bridge over Fox river, at Green Bay, Wis., was burned July 3.——A railway bridge of 8 spans at Dix, Neb., was burned July 7.——At Helena, Mont., on July 7, while workmen were repairing the Higgins Ave. bridge over the Missoula river, the structure gave way, throwing 9 men into the river 20 ft. below. One man was killed and several injured.——The Rio Grande bridge at Laredo, Tex., was damaged by a flood July 11, some of the piers being shifted. A railway bridge at Benbrook, Tex., has been destroyed.——A bridge on the Mexican Central Railway, near Chihuahua, gave way under a passenger train July 8, the supports having been undermined by floods. There were 2 persons killed and 25 injured.

SERIOUS FLOODS AND WASHOUTS have occurred in the Atlantic States. The most serious case was at Johnstown, N. Y., last week, heavy rains having swollen the creeks and rivers; the floods carried away 2 or 3 mill dams, culverts, and several bridges (on one of which a number of people were standing), and damaged several buildings. The Mohawk river rose over 6 ft. in half an hour at Amsterdam, and washed out a culvert under the four tracks of the New York Central Railway. Near Palmer Lake, Col., a flood caused a serious washout on the Denver & Rio Grande Railway, on July 8. The Schuylkill river has been very high, with 7 ft. of water passing over the Fairmount dam at Philadelphia.——Floods caused a washout on the Maryland Central Railway at Guilford station, Md., on July 13, and did other damage.

A LOCOMOTIVE BOILER EXPLOSION occurred July 16 at Topeka, Kan. The engine was a switch engine, and was hauling a train of cars when the accident happened. Two men were fatally injured.

THE OKEFENOKEE SWAMP, covering 350,000 to 400,000 acres in Georgia, is to be sold at 12½ cts. per acre, according to a bill now pending in the Georgia Legislature. The Atlanta *Constitution* denounces the proposed sale as a swindle upon the public, and it says that for about $40,000 the greater part of the swamp may be drained, and $100,000 so expended would convert it into good bottom land worth $5 per acre. The *Constitution* wants the State to undertake the work.

RAILWAY STATION ADVERTISING, which has become an intolerable nuisance in England, is made the subject of a bill now before Parliament. This bill provides that after Nov. 1, 1889, it shall be obligatory on every railway company to display two station signboards on both up and down lines, placed in conspicuous places, and to indicate with plain letters, at least as large as any advertising sign used at that station, the name of the station. After the same date it shall also be unlawful for any railway company to exhibit any advertisement within 10 ft. of the station sign, under a penalty of £5, and a further penalty of 40s. for each day the sign is allowed to remain in its forbidden position.

A BRIDGE-BUILDING TRUST is said to have been developed in and about St. Joseph, Mo., says the St. Louis *Globe-Democrat*. Proposals were asked for building eighteen county bridges, and though twenty bids were received, the difference was so slight as to cause inquiry to be made. All bids were rejected and the work will be let to private parties. The claim is made that a trust among bridge-builders was unearthed, a trust which embraced Southern Iowa, Nebraska, Northern Kansas, and Northwest Missouri. The object was the maintenance of prices at a maximum, and severe penalties were enforced for any violation of the agreement among its members.

AUTOMATIC COUPLERS are to be in use on all locomotives and freight cars in operation in the State of New York on and after Nov. 1, 1892, which are owned by the companies operating railways within the State. A fine of $500 is to follow the neglect to comply with the provisions of the act.

THE PANAMA CANAL is to be resurrected by Mr. H. B. SLAVEN, president of the American Contracting & Dredging Co., says newspaper gossip. Mr SLAVEN is on his way to Paris and "it is supposed" that he goes there to close a contract of $200,000,000 for the completion of work on the canal.

THE HELL GATE IMPROVEMENTS, says Col. GILLESPIE, in his last report on New York harbor, will still require several years to complete. He proposes to expend $400,000 there in removing Flood Rock and operating the steam drill scow on minor channel obstructions. For the main ship channel, in the lower New York Bay, $160,000 is asked. There are no indications of shoaling in Gedney's channel since last December. For the Harlem river work $1,000,000 is required to conduct it at all economically.

THE MISSISSIPPI RIVER, between the Illinois and Ohio rivers, may be reduced in width to 2,500 ft. according to plans prepared by Major MILLER, U. S. Engineer. He reports that $1,000,000 may be profitably expended in doing this during the next fiscal year.

RELATIONS BETWEEN THE ERIE AND THE NYPANO are becoming somewhat strained, and the Trustees of the latter have demanded an arbitration of the points of difference. If this is refused, a resort will be had to the courts.

Testing the Hawkesbury Bridge.

Our contemporary, *Indian Engineering*, gives the following account of the official test of the Hawkesbury bridge on April 16, last. The contract with the Union Bridge Co. stipulated that the completed span should be able to carry a load of 900 tons without deflecting more than 1-1200th of its length, or 4⅛ ins.

The arrangement made by the railway authorities were very complete and consisted in placing at the disposal of the engineers six of the heaviest type of goods engines, 16 trucks containing an enormous load of railway iron and two brake-vans. Two of these trains were dispatched from Redfern at 4.30 and 5 o'clock respectiveiy on the morning of the 24th April while one was sent to the scene the previous eveuing. Upon the arrival of the last train at Brooklyn, the whole was divided into two equal trains, consisting of three engines, the average of which rather exceeded 64 tons, eight trucks weighing 32 tons each, while the brakes turned the scale at 12 tons. It was arranged that one of these enormous loads should be backed on to the bridge along the down set of rails, while the other was to proceed forward in the same direction. At a few minutes after 8 o'clock the signal was given for the trains to slowly run on to the first span of the bridge, where a survey party, under Mr. RHODES, was ready to detect the slightest deviation from the normal level. Besides this almost infallible scientific test, the inspecting engineer had attached a pipe of water on each side of the bridge fitted every few feet with indicators. When the huge weight (amounting to 924 tons) commenced to run on the bridge, the excitement amongst the professional gentlemen present was intense, each one of the water level indicators being closely watched. On the first test with the load being made, it was seen that the water in the glass tube attached to the pipe had ascended to a height of 1 in. near the ends and 2⅛ ins. in the center. The theodolites confirming these figures, the engines were then slowly backed off. The span when relieved of its load went back within a hair's breadth of its former position, thus showing that no permanent set had resulted from the test. The whole of the other remaining spans were tested in a similar manner, they all averaging the same amount of deflection, a result eminently satisfactory, not only to the contractors, but to the country at large The sixth span was tested with even more minuteness, it being 4 ft. longer than any of the others, and these extra few feet were thought by many to be a source of weakness. This span, however, stood the test with a success equal to any of the others, the deflection being no greater. Numerous other tests were made, such as placing four locomotives together and taking the deflections of the cross girders; trying the strength of the structure in a longitudinal direction, and so on. In every instance the results proved satisfactory.

The trials concluded with the speed test, which consisted in running a heavy train over the bridge at a high rate of speed, and marking the vibrations. The result, however, only proved the marvellous strength of the structure.

All present expressed themselves as highly pleased with the satisfactory results obtained from the tests, and congratulations were poured in upon the engineers and contractors engaged upon the magnificent work.

The Janesville Water-Works, Janesville, Wisconsin.

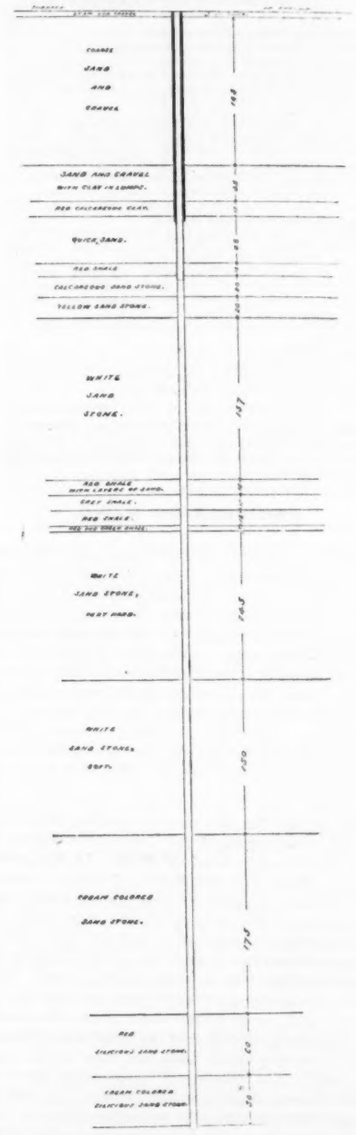
During the last ten years the construction of water-works for villages, towns, and small cities has grown to be so important an industry that the branch of engineering demanded by such work has not only afforded practice for many members of the profession but has induced many older general practitioners to become specialists in the designing and constructing of water-works systems, and the varying conditions met with and the difficulties encountered make the practice one of no small importance. With the exception of a few excellent treatises, bearing more particularly upon the higher branches of the practice, there is a scarcity of literature which might be useful as a guide to the young engineer, or for reference by his older brother. For this reason, as well as with a view to interesting our general readers, we give in this issue a description of the water-works of Janesville, Wis., which not only are of excellent design and construction throughout, but which embody a greater number of important features than are usually to be met with in a plant of like capacity.

The city of Janesville has a population of 12,000, is the county seat of Rock County, Wisconsin, and is located on the Rock river, which in its flow through the city varies in width from 400 to 700 ft., and into which the drainage of the town is emptied, rendering it unfit for domestic uses, and the water is so hard that it is undesirable for steam-making purposes.

After several years' agitation of the question of water-works, the city granted a contract to W. E. Swan & Co. for drilling an artesian well, with a view to obtaining a supply, and for that purpose selected a site on property owned by the city: namely, in what would be the gutter of River St., provided the street had been properly graded. The site thus selected was 150 ft. from the west bank of the Rock river. The well was commenced by sinking 10-in. casing or tubing to a depth of 205 ft.; then 8-in. wrought iron pipe was inserted, and the boring continued at that diameter to its entire depth of 1,087 ft., the pipe being carried down to, and firmly driven into, the stratum of calcareous sandstone at a depth of about 260 ft. from the surface. Its uppermost joint or coupling was 5 ft. below the surface of the ground, leaving a short length above to be removed and replaced with well connections applied later.

The 8-in. pipe thus inserted effectually cases off the surface water, which is much harder than that obtained from the lower strata, and of an inferior quality, besides confining the flow of the well to point of delivery. During the work of drilling, the 8-in. pipe extended about 2 ft. above the surface of the ground, and when the boring had reached a depth of about 300 ft., water began to flow freely over the top of the pipe, increasing as the stratum of white sandstone then reached was penetrated deeper. When the 800-ft. level was reached, the flow of water was increased three-fold, while the increase beyond that depth was not sufficiently rapid to warrant going deeper than shown in the accompanying diagram, Fig. 1. To test the height or head of the flow, the 8-in. pipe was extended upward, showing the water to rise 28 ft. above the surface of the ground. By careful weir measurements, conducted through the summer of 1887 by Mr. WILLIAMS, the resident engineer, it was found that the discharge of this well, at a height of 4 ft. above the surface of the ground, was uniformly at the rate of 587 galls. per minute, at a temperature the year around of 56° Fahr., and it might be well to state here that when drawing direct from the well with the pumps, this yield is increased to 810 galls. per minute.

Mr. E. G. SMITH, Professor of Chemistry, Beloit College, Beloit, Wis., who has made an exhaustive study of this water-bearing formation, states that it is of immense area, underlying several counties in the southern part of Wisconsin and extending into the northern portion of Illinois; and that the Potsdam sandstone, from which the artesian wells receive their supply, is of thickness varying from 500 to 2,000 ft., with a general dip to the southeast, and that further south than Janesville it is reached at a greater depth from the surface; but that artesian wells are not procurable at all points, owing to local conditions, which must be carefully observed; notably, the important geological formations, the drift, the high ridges, and valleys along the rivers, all of which come in for careful consideration. He further states that wherever the Potsdam sandstone can be reached and a flow obtained, as at Janesville and many other points, the waters are of excellent character. We append a summary of a very complete analysis of the water of the Janesville well, made by Prof. SMITH.



Strata Penetrated by Artesian Well; Janesville Water-Works.

The summary of analysis made of the water from this well is expressed in the following results:

	Grains per U. S. gallon.
Potassium Sulphate	.1166
Sodium	.4083
Sodium Chloride	.4899
Sodium Phospate	Trace
Calcium Sulphate	.3149
Calcium Bicarbonate	12.0457
Magnesium	12.6640
Iron	.0874
Alumina	.0933
Silica	.5306
Total	26.7567

Hardness expressed by Clark's scale:

Permanent hardness	8.8°
Temporary "	2.4°
Total hardness	11.2°

Having secured an ample supply of good water for the present needs of Janesville, the city granted a franchise to Turner, Clarke & Rawson, of Boston, in May, 1887, for the construction and maintenance of a system of water-works, the details of construction of which are here given.

Having secured a supply of water, the next thing to be done was to store the same for distribution. For this purpose a small reservoir of 850,000 galls. capacity was constructed in the immediate vicinity of the pumping station, as shown in drawing, Fig. 2. There being no clay upon the proposed site of the reservoir, or in the vicinity thereof, which might be used for puddling purposes, it was found necessary to construct a core wall within the embankment, of masonry, 2 ft. thick, laid up in hydraulic cement, and united with this, and covering the entire slopes and laid at right angles to the slope in 5 ins. of screened gravel.

A circular reservoir of the same capacity, with vertical walls of masonry, could have been constructed for less money, but, from information received from other water-works supplied from artesian wells sunk in the same strata, it was found that the growth of algæ in the summer had given a great deal of trouble, and to avoid this was the reason for constructing the basin of rectangular form and sloping sides, so that any slight growth of algæ ranged for an 8 in. overflow, and with a 14-in. branch flanged to the end of the 20-in. suction pipe connecting with the pumps, this suction pipe containing the condenser tubes. The condensation is performed by the passage of the water around these tubes on its way to the pumps, thus giving good results as to vacuum without wasting water, and with a smaller air-pump capacity than would be required with a jet condenser, and without raising the temperature of the water more than 1° Fahrenheit. By reference to Fig. 2 it will be seen that

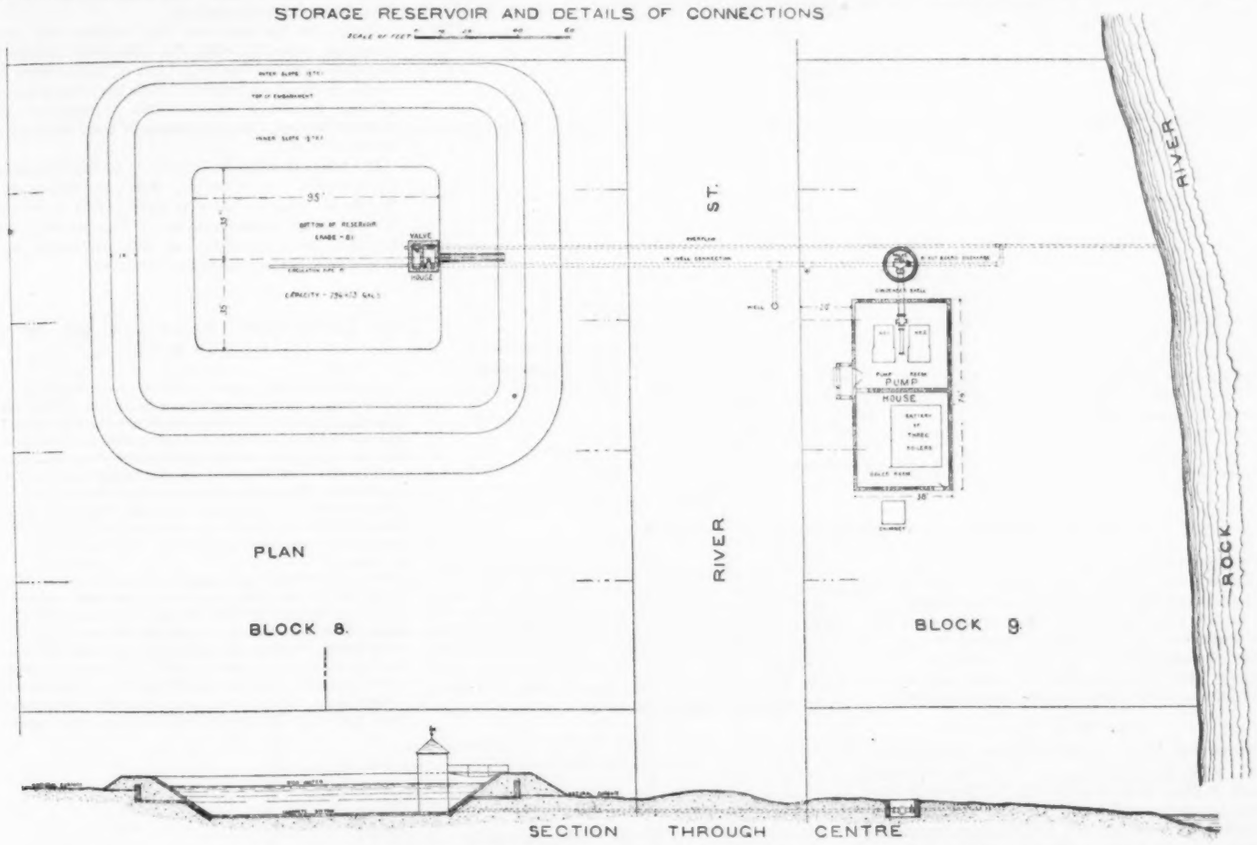


Fig. 2. The Janesville Water-Works, Storage Reservoir and Details of Connections.

and bottom of the reservoir, was laid a good cement concrete lining of 5 ins. thickness, over which

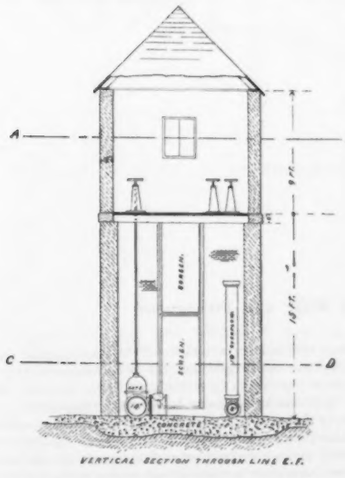


Fig. 3. Screen House; Elevation.

a coat of cement plaster ¾ in. thick was applied and carried up the face of the core wall its entire height. The embankment was then thrown up over the wall, forming slopes of 1¼ to 1 both inside and outside, and over the inner slopes was laid a pavement of sandstone broken into blocks 8 ins. thick which might take place between the periods of pumping would, during the hours of pumping, when the basin would be lowered some two feet or more, be deposited on the paving of the slopes and killed by being exposed to and dried by the sun. In operation this is actually found to be the case, the very fine, thread-like growth being carried by the prevailing wind to the leeward slope, and thus destroyed, leaving the entire surface of the water clear from any collection of the growth. To further assist this, however, care was taken in the location of the screen house, to extend the circulating pipe conveying the discharge from the well to the side of the basin furthest from the screen house, while the overflow pipe is within the screen house, thus giving a fairly rapid circulation of the water, and a change of the entire body in 24 hours.

With a view to reducing the size and cost of the screen house, which also contains the valves for operating the basin for cleansing or other purposes, a special arrangement of check valves was made with a view to economy of space, and this arrangement is explained by reference to Fig. 3, and enlarged drawing of check valves in Fig. 4.

The water in the reservoir is maintained at 11 ft. depth, which gives a head of about 6 ft. above the centre of the pump plungers, and from the check valves, as shown on cuts above referred to, is connected a 14-in. pipe leading to a dry valve well at the end of the pumping station, and to this pipe the artesian well is connected by an 8-in. branch.

On this 14-in. pipe has also been left a second 8-in. tee to be connected with a second well should same be deemed necessary in future. The 14-in. pipe terminates in the valve well with a special tee arwhen the pumps are at rest, the water is being delivered into the reservoir through the 8-in. circulating pipe, and when the pumps are started, the 8-in. check valve in the screen house closes, while the 14-in. opens, admitting water in the 14-in. suction pipe or well connection, after having first passed through the screens, the water thus taken being to

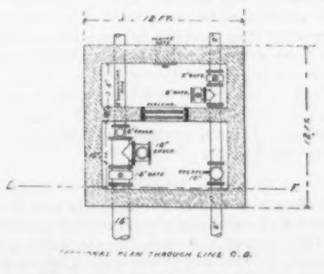


Fig. 3a. Screen House; plan.

supply such demand of the pumps as may be in excess of the yield of the well. By the arrangement of the gates in the screen house, together with the 8-in. gate in the dry valve well, the water from the artesian well may be delivered at any time direct into the overflow to the river, and the reservoir drawn off for cleansing or repairs; or, if necessary the screen house may be emptied for access to valves without drawing off the reservoir, and either of these operations may be performed without for a moment stopping the flow from the artesian well. Fig. 5 gives an enlarged view of the special tee lo-

cated in the dry valve well for the connections above described.

A small foot-bridge, leading from reservoir embankments to the screen house, was constructed in the manner shown by Fig. 6, with stringers and thwarts of 4×6 in. hard pine, and with trusses and rails of 1¼ plain wrought-iron pipe. The ends of the stringers abutting against the screen house

THE JANESVILLE WATER CO.

ARRANGEMENT OF CHECK VALVES IN SCREEN-HOUSE.

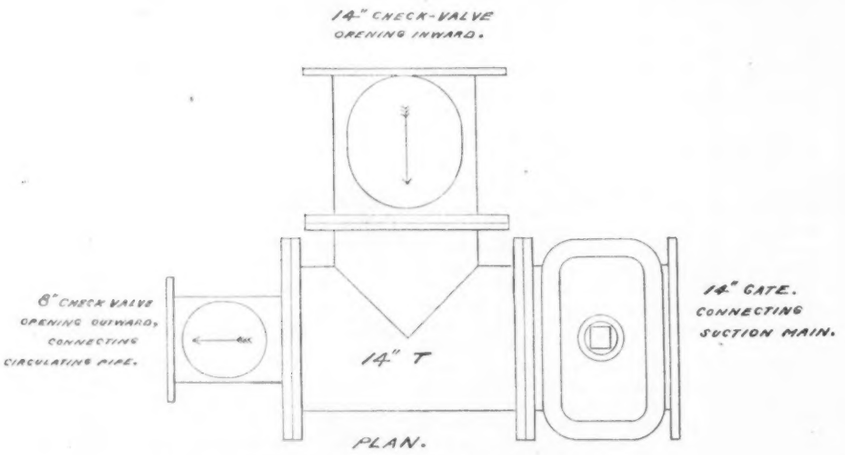

14" CHECK-VALVE OPENING INWARD.
8" CHECK VALVE OPENING OUTWARD, CONNECTING CIRCULATING PIPE.
14" T
14" GATE. CONNECTING SUCTION MAIN.
PLAN.

Fig. 4. Arrangement of Check Valves in Screen House.

-re supported by wrought-iron brackets bolted to the stone belt course of same, while the ends of the rails projected some three inches beyond the stringers, loosely entering dowel holes drilled into the brickwork each side of the doorway, merely to steady the ends of the rails from vibration. This bridge is very light and rigid, serving its purpose admirably, and its entire cost was less than $16.00.

PUMPING PLANT.

The engine house is a handsome structure of brick, with stone trimmings, 38×74 ft., being arranged in plan as shown by Fig. 7. Power is furnished by three horizontal tubular boilers, with shells 5 ft. in diameter and 16½ ft. long, each containing 58 tubes, 4 ins. in diameter and 15 ft. long. This large boiler capacity was to meet the city requirements, two boilers being very ample for the entire demand of the plant, and one only being used at a time to furnish steam for pumping.

The engines were built and erected by the Geo. F. Blake Mfg. Co., of Boston, and are of the duplex, compound condensing type, having high-pressure cylinders 14 ins. in diameter, low-pressure cylinders 28 ins. in diameter, water plungers 14 ins. in diameter, and all 18-in. stroke, the two engines being duplicates in every way. The machinery is so arranged that nothing appears above the engine room floor excepting the two engines proper, the heater, air pump, condenser, and all piping being confined to the cellar and basement, leaving only the main steam pipe exposed in the engine room. For details of main connections reference is made to drawing, Fig. 7*b*.

PIPE DISTRIBUTION.

The system of mains as originally laid consisted of 13 miles of cast-iron pipes, ranging in diameters from 16-in. to 6-in. the pumping plant being located practically at one end of the system while a standpipe of 25 ft. diameter and 85 ft. height is located at the opposite end of the system on an elevation 100 ft. above that of the pump house and on the opposite side of the river therefrom. The franchise required two river crossings, one 8-in. and the other 12-in. in diameter, but as both these were located by the city authorities near the southerly end of the distribution system, the constructors deemed a third crossing necessary for proper circulation, and to this end added a third 8-in. crossing at the northerly part of the system. As this was in the widest portion of the river in its flows through the city, and where the water was so shallow that a submarine crossing could not be properly protected, an 8-in. line of pipe was laid in a boxing supported on the piles of North Fourth Street Bridge.

The construction of this box, with a view to proper insulation, is given in drawing, Fig. 8. Around the pipe and within the inner box, the space was filled with lamp-black, which is not only an excellent non-conductor, but, being a non-absorbent material, it is practically indestructible for the purpose for which it is there used. Between the inner and the outer boxes is left simply a dead air space. This box is supported by brackets of wrought iron, 1 x 3½-in. which were secured to the piles by U bolts and straps. The points in such crossings most liable to give trouble from freezing are the shore ends where they enter and connect with the underground mains. This is usually, however, because the care that was taken for protecting the pipe by the boxing proper is not continued to where the pipe enters the trench. In this case, however, the insulation was continued by brick wells at each shore end, to which the boxings were joined in a manner best shown and explained by drawing, Fig. 9. The mains throughout the town are laid to a depth of 5½ ft. cover, and although zero weather is very common at Janesville, with a fall of 8° to 30° below, yet under these severe conditions, the crossing has remained open and free from freezing. The two submarine crossings were laid in deeper water by Messrs. Thacher & Breymann, of Toledo, using their form of joint, which is too well known for description here.

As a goodly portion of the town is located upon an elevation not much less than that of the base of the standpipe and as good fire-pressure cannot be obtained from standpipe head alone on these high levels, the standpipe connection is arranged with a 10-in. gate, which is connected by electric wires with the pumping station and closed from there by throwing over a switch in the pump room. By this means direct pressure, as high as required, may be applied to the entire system.

Owing to the generous pipe system and large pumping capacity, with the additional benefit of the standpipe and the large body of water stored for excessive demand, together with the care given to all the details of construction throughout, the Janesville works are the finest of their capacity in the Northwest.

The plant throughout was built by the Wisconsin Construction Co., of Boston, Mass., and designed by Mr. B. R. CLARKE, their engineer, with J. FRANK WILLIAMS as resident engineer. This journal is indebted to Mr. CLARKE for the clear and satisfactory description of these works as here given.

THE JANESVILLE WATER CO.

CONNECTION BETWEEN SUCTION MAIN & CONDENSER, IN VALVE-WELL AT END OF PUMP-HOUSE.

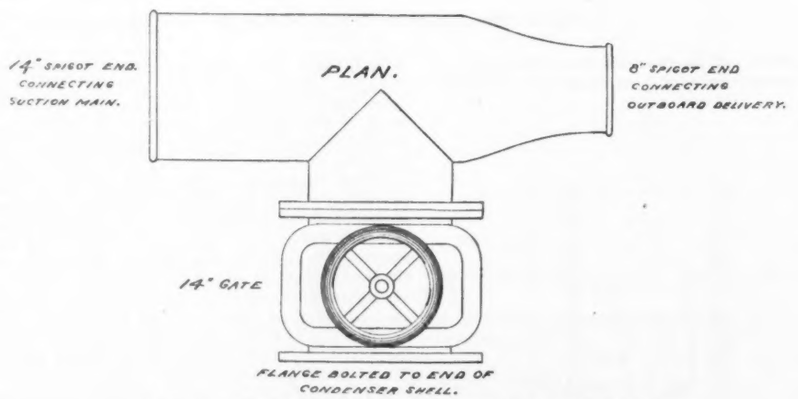

14" SPIGOT END. CONNECTING SUCTION MAIN.
PLAN.
8" SPIGOT END CONNECTING OUTBOARD DELIVERY.
14" GATE
FLANGE BOLTED TO END OF CONDENSER SHELL.

Fig. 5. Connection between Suction Main and Condenser.

The Improvement of Railway and Street Railway Tracks.*

In preparing this paper for the Convention I have had in view the purpose of opening a discussion on this very important subject, as experiments and improvements in matters relating to track are all the time being made by railway engineers, superintendents, and others in various parts of the country, but the particulars are often not known to others interested who may be working, or trying to work, in the same line; and it is to be hoped that the following notes may offer points upon which to start a full discussion as to opinions, practice, and experience.

I have just said that many improvements are being made; but on the whole, the progress of track improvement is far behind that of the motive power and rolling stock. The size, power, and weight of the locomotives and the size, weight, and capacity of the cars have been increased; the fitting and furnishing of passenger rolling stock has been brought to a high degree of elegance and convenience, while at the same time safety appliances have been very extensively introduced, so that passengers may ride in comfort and safety, as far as the train themselves are concerned, and the better construction of the engines and cars is an economy for the railway companies. The track, however, is generally improved only in so far as it must be; and although the improvements which are being made from year to year by different individuals mark a certain rate of progress, yet the average of the improvement has by no means kept pace with that of the rolling stock, and it certainly seems inconsistent to run trains of heavy, elaborately fitted and finished cars, hauled by heavy engines of first-class construction, over a track consisting of 56 to 70-pound rails,

* A Paper by Mr. E. E. RUSSELL TRATMAN, Jun. Am. Soc. C. E. (Assoc. Ed. ENGINEERING NEWS) read before the Convention of the Am. Soc. C. E., June 25, 1889.

more or less securely spiked to the ties, and having, among other deficiencies and dangers, numerous switches, which break up the main track, but are left practically or actually unprotected. An illustration of this, which I mention because it was within my own experience, was an accident on the Portland & Ogdensburg Ry., in Maine, in 1886. The train was an express from Montreal and had day and parlor cars; the track was fairly good, and the train was going at good speed, when the engine struck a trailing stub switch which had been left set for the side track, and as there was thus a break in the continuity of the main track, the wheels dropped off the ends of the rails onto the ties. The engine fell over on its side and the tender smashed the cab, the baggage car went up the side of a shallow cut and into a field, and the first passenger car was stripped from its trucks and stopped with the front end resting on the slope of the cut. The engineer and fireman were both killed. With a misplaced split switch, as a trailing switch, no accident would have occurred, and even had the stub switch been protected by ordinary switch lights, the engine driver might have been able to prevent the accident. The Railroad Commissioners of Maine probably had this accident in mind when, in their report for 1886, they recommended the enactment of a law requiring every road in the State that had trains running at night to place safety switches and lights at every siding which such trains pass without stopping. The railway authorities in Australia take especial care to prevent accidents of this character, as will be seen later on, under the head of "Signals and Interlocking." The above accident was one of minor importance comparatively; but how frequently does the daily press report cases of trains of all classes, express and local, passenger and freight, being turned off the main track by a misplaced switch, with more or less serious results! But the switch is only one point of danger; the frog is another; and slight or serious accidents are constantly being caused by broken rails, bad joints, or by the spreading or overturning of the rail. Defective joints, sometimes with one or two of the bolts loose or dropped out, and defective fastenings, with loose or worn spikes, are only too common, and, as I remarked in my paper, read at the last Convention, "Any one who cares to make a little observation can learn some very startling facts on the matter of rail fastenings."

Hundreds of accidents every year are attributable to deficiency of track. The familiar claim is made that railways cannot afford the expense of first-class track; but then they continue to put on heavier engines and more elegant cars, and say that the public demands extra accommodations. I am fully alive to the fact that the public is a very unpleasant factor in railway economics, being an unreasoning body which wants a maximum of convenience at a minimum of cost, and wants especially things that it can see and appreciate and that appeal directly to its senses. With two railways between the same points, one line advertising the excellence and safety of its track, and running ordinarily comfortable cars; and the other line advertising the elegance and safety of its cars, and running its trains over light rails and an inferior track, the latter would probably be the better patronized. It is interesting to notice, however, as one of the signs of the times, that the time-tables of some of the principal railways, published in the daily papers, contain allusions to the excellence and safety of the track as well as of the rolling stock. It certainly seems that there ought to be some way, and that there must be some way waiting for the right man to find it, by which railways will be able to lay and maintain a good, safe track, and still keep up a favorable reputation with the public. I am not going to discuss this question now, but hope the suggestion may fall on good ground and bring forth fruit abundantly.

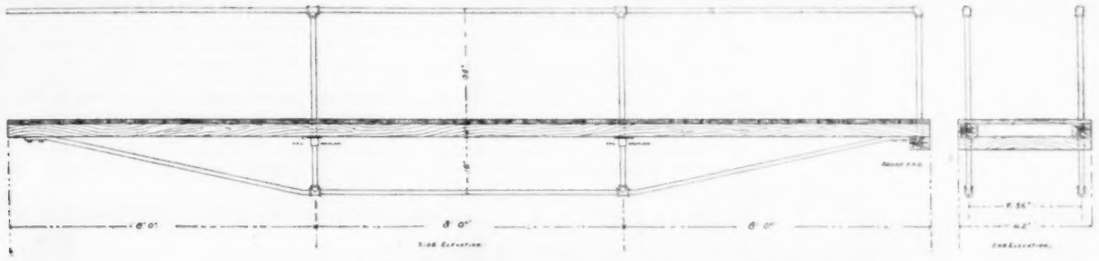


Fig. 6. Foot-Bridge to Screen-House; Janesville Water-Works.

RAILS.

The question of the form of rails has been gone into very fully by a committee of the Society, and the type of section generally approved seems to be one with a wide, shallow head, similar to the 80-lb. section of the Michigan Central and the New York Central railways. [See ENGINEERING NEWS, March 9, 1889.—ED.] There is one point, however, on which I would like to offer a sugges tion in regard to this section: rail manufacturers and engineers are now endeavoring to get a good rail steel that will stand considerable wear; and if such steel is obtained, and is rolled into rails with shallow heads, would not the heads be unduly weak when partly worn, and therefore detract from the general life and value of the rail?

As to weight there are in actual service rails weighing 80 to 90 lbs. per yd., and sections of the "Sayre" rail have been prepared by its designer, Mr. SAYRE, for weights of 84, 92, 101 and 110 lbs. per yd., the general proportions being similar to those of the 76-lb. rails in use on the Lehigh Valley railway. [See ENGINEERING NEWS, Feb. 26, 1887.—ED.] For lines with heavy traffic, the minimum weight of rail should be 80 lbs. per yd. It may be objected that this is going ahead too rapidly; but if you will think of the traffic, the weight of the trains, and the pounding of the wheels, you will probably recognize that 80 lbs. is not too heavy. For what may be termed secondary trunk lines, 75-lb. rails may be admissible, until such time as the railway companies realize the advantages of a heavy track, or until the use of such track is in some way enforced. For lines with local or ordinary light traffic, lighter rails may continue to be used; but in looking through reports of railroad commissioners, I find Southern roads with 50 to 60-lb. rails over which Pullman cars are run. As to heavier rails, it is not necessary to even hint at a limit; but it would be very interesting to see a modified form of Mr. SANDBERG'S 110-lb. Goliath rail tried here, with its sole plates and screw fastenings. [See ENGINEERING NEWS, May 21, 1887.—ED.] A case in which it seems as though the use of heavy rails was being carried to an unnecessary extreme, is the introduction of some 110-lb. Sandberg rails into Victoria, Australia. It may be that the present or prospective traffic is sufficient to warrant the use of such a rail; but from what we know of the traffic, an 80 or 90-lb. rail would appear to be ample. A statement has recently been going the rounds that rails 60 ft. long have been rolled for experiment on the Pennsylvania Railroad.

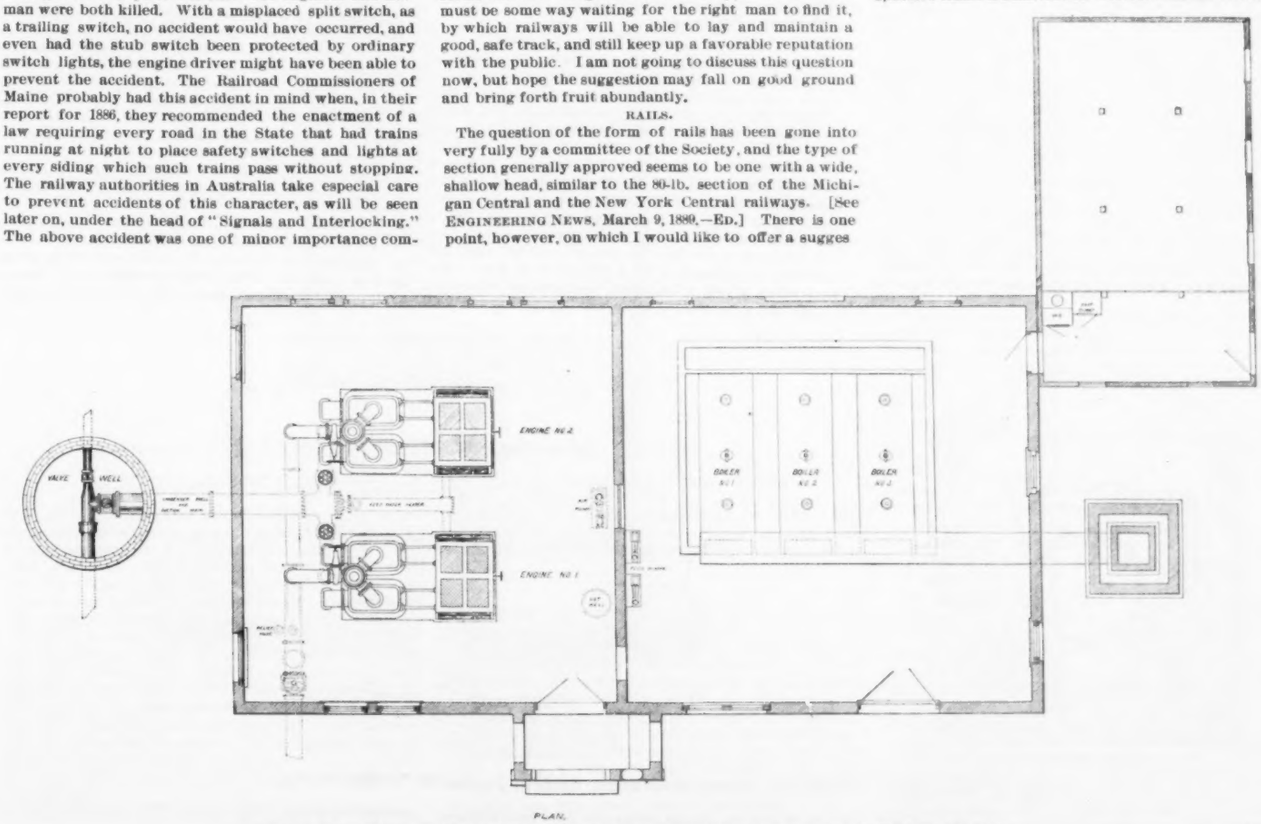


Fig. 7a. Plan of Engine-House and Pumping Plant; Janesville Water-Works.

Mr. DON J. WHITTEMORE, M. Am. Soc. C. E., in closing his paper on "Cylindrical Wheels and Flat-Topped Rails," says: "If a change is necessary, why not have our form of rail a type of that noblest of all creations, a level-headed man with two legs and feet to correspond? Why not come back to the design of the American Strickland of 1834, redesigned by BRUNEL in 1835, and still in use on the Great Western Railway of England?" In this connection it may be noted that in 1885 Mr. C. C. WRENSHALL (then of the Northern Pacific Railway) suggested an 85-lb. bridge rail with a 50-lb. combination splice and joint plate. This rail was 4½ ins. high, with a head 2⅝ ins. wide and about 1⅞ ins. deep; top radius, 6⅝ ins.; ar

dius of top corners, $\frac{5}{16}$ ins. The side webs were ½ in. thick and the base width was $6\frac{7}{8}$ ins.

BALLAST.

The various merits of different materials have been very widely discussed, and the majority of opinions appears to be in favor of broken stone rather than gravel for main tracks. In the iron districts slag is used, and should be about as good as broken stone except, perhaps, for a chemical action, injurious to the rail, which is said to exist. In England a very general practice is to use a "boxing" or sprinkling of gravel over broken stone ballast, which deadens the noise and makes a very pleasant road-bed to ride over. It has been suggested that the South American practice of using soft loam and letting the grass grow over it might be tried with advantage on some Western roads in the dry regions.

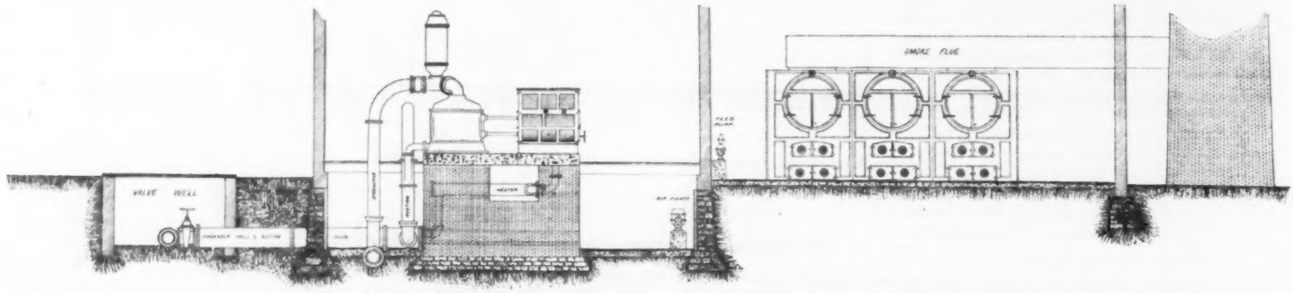


Fig. 7b. Elevation of Pumping Plant; Janesville Water-Works.

TIES AND TIE PLATES.

The principal improvements to be made are in keeping the track supplied with good, sound ties, and in increasing their durability. They are often left in the track after being rotted, split by spikes, deeply flange worn, or otherwise damaged. Suitable species of timber are not always availed of, and it is only about two years ago that the Department of Agriculture called attention to the fact that the chestnut oak, which grows in the South, and is felled for its bark, the timber being left to rot, is an excellent material for ties, better than some woods already used. The result of this has been that a large amount of hitherto wasted timber has been successfully used for ties. Preservative processes do not seem to have met with much favor in this country for ties, and the principal method of increasing their life in the track is by the use of metal tie plates. These may be divided into two classes:

First.—Those which are merely thin plates and are used in connection with the ordinary spike. Of this class are the Servis and the Perkins plates. [See ENGINEERING NEWS, March 16 and 23, April 3 and May 18, 1889.—ED.] The former is a shallow channel iron about 8 x 3 ⅜ ins., $\frac{3}{8}$ in. thick, and having flanges ⅝ in. deep which are driven into the tie. The spikes may be driven through or outside of the plates. The latter is similar, but rests on a thin wooden block, the spikes passing through the plate, block and tie, which has the disadvantage of shortening the hold of the spike in the tie.

Second.—The larger plates which are used in connection with improved fastenings to the tie. Of this class are the Thomson (Pennsylvania Railroad), [See ENGINEERING NEWS, May 11, 1889.—ED.] the Post and the Sandberg plates, and the Stuart elastic plate. [See ENGINEERING NEWS, April 27, 1889.—ED.] This class is extensively used in Europe. The Pennsylvania Railroad plate is 5 x 9 in., ⅜ in. thick under the rail, with a rib along each side. Mr. SANDBERG's plate is very similar, and he has also a flat plate with bent clips stamped up out of the metal. Mr. POST uses on the Netherland State railways a plate with teeth on the under side to bite into the tie and prevent slipping. The Stuart "elastic" plate is bent so that the rail rests on the unsupported ends of the plate, the metal giving slightly under the weight of trains.

Steel is probably the coming material for ties, and with it will come better joints and fastenings. Many objections have been made; but in view of the experience and progress in other countries, there is little reason to doubt the practicability of the use of steel. Apart from its use as a means of reducing the consumption of timber, it makes a superior class of track, and is therefore well adapted for main lines without regard to the condition of the timber resources.

TIE FASTENINGS.

In tie fastenings great improvements can be and should be made, and it is hoped there will be some discussion as to new devices and the results obtained with them. The old-fashioned spike, still in almost universal use, is not sufficiently secure for tracks with heavy traffic, as the rail gradually draws it out of the tie, in which it is held by friction only. In answer to an inquiry as to spikes for 80 or 100-lb. rails, Mr. T. A. MEYSENBURG, of the Tudor Iron Works, St. Louis, has kindly sent me a drawing of a spike which he considers suitable for such rails; it is 6¼ ins. long over all, $\frac{11}{16}$ in. square under the head, and ½ in. square in the shank; the points is 1¼ ins. long, the head is 1⅜ ins. square and has a projection of $\frac{1}{16}$ in. Different forms of spikes have been designed, including the McLean spike, the jagged spike, and the bayonet spike. There is also the Davies lock-spike [See ENGINEERING NEWS, June 1, 1889.—ED.], which is a thin, flat steel spike, having the shank at an angle with the head, so that it drives diagonally into the tie, parallel with the rail, and it is claimed that this will prevent the rail from drawing it; the end has cutting edges to prevent too violent a tearing of the wood as the spike is driven across the fibre; two spikes are used to each rail, sloping in opposite directions, and for curves they are made of extra width, so as to present a broad surface to resist the thrust of the rail and to avoid the use of rail braces. These spikes have been in use for some months. Spikes are, I believe, used with the Philadelphia & Reading 90-lb. rail.

The only apparent way to prevent the drawing of the fastenings is to give them a real hold or bearing, instead of relying on friction; this bearing can be obtained by the use of bolts or screws. [See ENGINEERING NEWS, April 27, 1889.—ED.] With the English fang-bolt fastening the bolt is either placed with the head bearing on the rail washer, in which case it is screwed down into a fang-nut on the under side of the tie, the nut having sharp edges which bite into the wood and so prevent turning; or a better plan would be to have the head of the bolt underneath, and prevented from turning, the nut being screwed down on the rail washer. Mr. SANDBERG uses a screw fastening, the head of the screw bearing directly on the rail flange and the rib of the tie plate. On the Northern Railway of France an 85-lb. rail is fastened by screws of a little different form to Mr. SANDBERG's; but, like his, bearing directly on the rail flange. Mr. POST uses screws similar to those on the Northern Railway of France, but clips or washers are used on one side of the rail. An objection to the use of bolts is the trouble of boring the holes and putting the pieces in position. All things considered, the screw fastening seems to be the best. A form of fastening which promises good results is that designed or adapted by Mr. M. W. THOMSON, Engineer of Maintenance of Way, Pennsylvania Railroad. It is similar in type to the Sandberg fastening, and has a similar tie-plate; but it has the advantage of using clips or washers to hold the rails, while the pointed screw can be easily started into the wood, thus expediting the track work. There are three ⅞-in. screws, about 5 ins. long, to each fastening. For the present it is intended to use only four of these fastenings to a rail length, which will enable the efficiency to be as well tested as with a larger number, and will reduce the cost of the experiment. The tie plates and washers can be rolled in bars and sheared to length.

In order to relieve the strain on the fastenings at curves, especially where spikes are used, the rails should be connected by tie rods, or gauge rods, such as are used at switches. They would probably be as efficient as, if not more efficient than, rail braces, and would increase the safety of the track while reducing the cost and labor of maintenance.

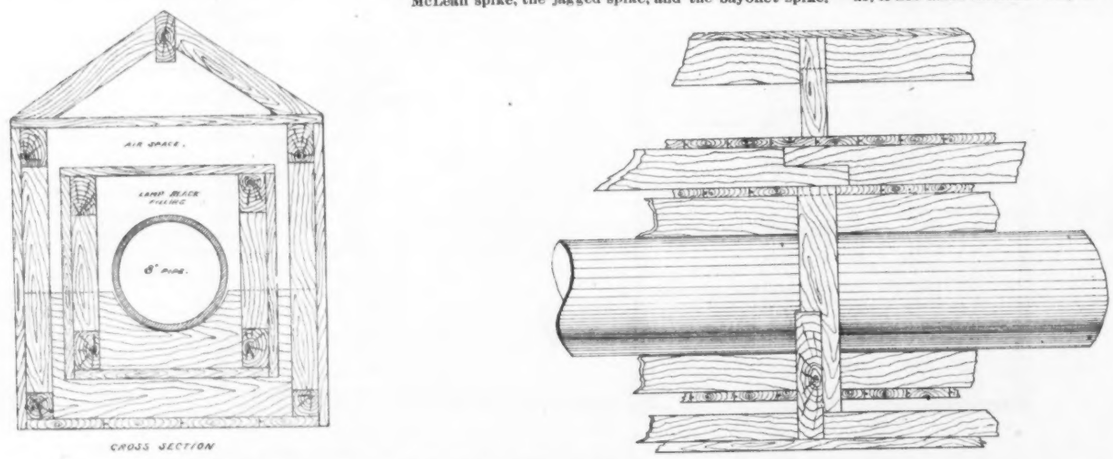


Fig. 8. Protection of Pipe on North Fourth St. Bridge; Janesville Water-Works.

JOINTS.

As far as inventions and devices are concerned, the joint is to the track what the car-coupler is to the rolling stock, and it would be an endless task to describe the different forms and arrangements that have been suggested and patented. With comparatively few exceptions, the usual form of joint for main tracks is the double angle bar joint, from 24 to 48 ins. long, with 4 or 6 bolts, and sometimes with a tie under the joint. The Savannah, Florida & Western Railroad has for its 70-lb. rails angle bars 48 ins. long, with 6 bolts. The Lake Shore & Michigan Southern Railroad has a joint of the same length. The Philadelphia & Reading Railroad uses for its 90-lb. rails a suspended joint, with bars 30 ins. long, and 6 bolts, the outer bolts being over the middle of the joint ties, which are spaced 22 ins. apart, center to center. The New York, New Haven & Hartford Railroad has for its new 73-lb. rail a joint of the same type, with bars 24 ins. long, secured by 4 bolts; the joint ties are 8 ins. wide and spaced 8 ins. apart in the clear. The New

York Central & Hudson River Railroad has a 3-tie joint, the rail ends being fastened to the tie by washers and a pair of Bush interlocking bolts; the angle bars are 40 ins. long, with 6 bolts. [See ENGINEERING NEWS, April 21, 1888.—ED.] The Chicago & Alton Railroad has also a 3-tie joint, with bars 40 ins. long and 4 bolts; the inner bar is 1¼ ins. thick. Compare these joints with those of European lines, on which short but sometimes deep plates, with 4 bolts, are generally used.

This is due partly to the weight of the rails. Mr. SANDBERG'S 110-lb. rail has only a 4-bolt joint, but the rail ends are secured to each joint tie by 2 screws, which pass through the flange of the angle bar. The use of a good and efficient fastening to the tie will very much reduce the trouble with the joints, as it reduces the leverage of the rail end. With an ordinary spike fastening on an ordinary track, the rail has considerable vertical play, and the splice bars and bolts are relied on to resist the strain and hold the rail ends in position. With a secure fastening, however, the leverage is limited to the distance between the joint-tie fastening and the rail end. The "Samson" bar is thickened in the middle to prevent breaking. Deep splice-bars, having a vertical web projecting downward from the horizontal flange, do not seem to have been used in this country; but Mr. J. W. CLOUD has designed a joint with this form of bar, and with bolts under the rail holding the lower webs tightly together. What joint the Pennsylvania Railroad will use with the new fastening already described, I do not know, but it is safe to predict that the very use of the fastening will save much trouble with the joints. Mr. C. C. WRENSHALL designed a joint in connection with his bridge rail, which consisted of a piece of rail 12 ins. long, placed between the ends of the rails and securely fastened; the idea is that as the worst wear from pounding occurs just beyond the end of the rail, this piece will take the pounding and can be easily replaced. Several forms of joints have been given a more or less extended trial, and there should be some interesting and instructive discussion on this subject.

Among other joints may be mentioned the Thomson, Fisher, Otis, Long (truss), Van Wie, Feary, Cox, and the spliced rail-joint. [See ENGINEERING NEWS, April 21, 1888.—ED.] The bevel joint, in which the rail ends are cut diagonally instead of square to the length of the rail, has been tried, but apparently without much success. Whether a joint with one rail end overlapping the other has ever been tried, I cannot say. The joint designed by Mr. M. W THOMSON [See ENGINEERING NEWS, June 1, 1889.—ED.], of the Pennsylvania Railroad, is in two pieces, each side of the joint forming a heavy angle bar and a bed plate. Only two bolts are used. The Pennsylvania Railroad has had it in use on about 6 miles of track with 85-lb. rails, during the past year, and the reports have been very favorable; the Chicago and Northwestern has made a trial and has ordered a large number for use with its new 72-lb. rail. The Fisher joint, which dispenses with splice bars and splice bolts, using only one holding down U-bolt, and which gives the rail ends a continuous bearing between the joint ties, has been in use for several years. The spliced-rail joint has the rail ends halved together and bolted through, splice bars being dispensed with. The side of one rail end has tongues which engage with grooves in the side of the other rail end, so as to prevent independent vertical play. One of the principal objects of a joint is to keep the ends of the two rails at exactly the same level, and a device to attain this end is a five-bolt joint used in India, the middle bolt passing through an aperture made by notching the webs of the rails at the end. Those interested in the subject of joints should read a paper by Mr. MAX J. BECKER, M. Am. Soc. C. E., on "Why do Rail Joints and Splice Bars Break?" read in 1885 before the Engineers' Society of Western Pennsylvania.

FROGS.

Frogs are responsible for many accidents, and the practice of cutting the main track rails at every insignificant little side track is much to be deplored, especially in these days of fast and heavy traffic. Safety frogs have been designed, in which the side track rails are gradually elevated so as to carry wheel flanges clear over the head of the main track rails, a movable piece, operated by the movement of the switch, bridging the gap over the main rails when the side track is in use. In this way the main track is unbroken. Devices for this purpose are in experimental use, but they ought to be extensively adopted. [See ENGINEERING NEWS, April 6, 1889.—ED.]

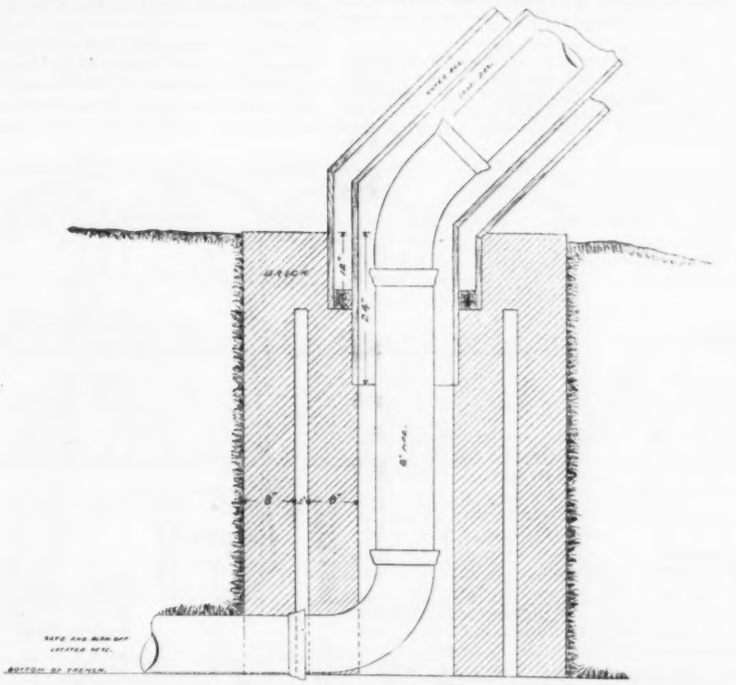


Fig. 9. Connection of Main with Bridge-Crossing; Janesville Water-Works.

SWITCHES.

During the past few years, there has been a very marked improvement in switch apparatus, and a very extensive adoption of the improved appliances; but there is still urgent necessity for their further introduction, and there is also room for further improvement in the apparatus. Split switches only should be used in ordinary practice, and facing switches should be avoided as far as possible; it will often be possible to reduce the number of facing switches. All main track switches at least should be fitted with a locking apparatus to hold the switch rails firmly in position; these switches should also be protected by and interlocked with proper signals.

SIGNALS AND INTERLOCKING.

A railway cannot be safely operated unless it is properly equipped with signals, and as the majority of them are used in connection with switches, they may fairly be mentioned here. In signals, as in switches, great improvements have been made, and their use widely extended, but there is still an enormous field for their introduction, as accidents occur every week at places which should have been protected, especially at switches. Every switch on a main line should be thus protected, as they are all about equally dangerous, whether at a crowded yard or a country side track. They should be arranged to fly to "danger" in the event of the switch being tampered with or forcibly opened, and should also be so arranged that they cannot indicate "track clear" unless the switch rails are properly and safely set. As to their form, the semaphore type is the one generally approved and almost universally adopted in all parts of the world. There should be a uniform code of orders conveyed by the position of the signals. At yards and side tracks all switches should be fitted with clearly distinguishable ground signals to facilitate the operations of switching; and there should also be the regular signals to protect the entrance to the yards. Home and distant signals should be placed at stations, especially on single-track lines; and such dangerous places as sharp curves in deep cuts should also be protected, as accidents are constantly occurring in such places. Railway grade crossings should be thoroughly protected by signals, and should also have a blind side track for trains which run past the danger signal. Highway grade crossings should be protected with visible or audible signals. Within a very recent date, electricity has come into practical use as a valuable adjunct to signalling, not only to operate the ordinary signals, but also to supplement them by audible signals in the engine cab or on the track.

The interlocking of switches and signals is one of the most important advances in railway equipment, and is necessary in order to obtain the full efficiency of the signal system for insuring safety and rapidity in operating heavy traffic. This subject is discussed by the railroad commissioners of some States in their annual reports. In Europe very complete systems of interlocking are adopted, owing to the great amount of traffic to be handled. In Australia the system is wisely used on the Government lines, as will be seen by the following extract from a report by the United States Consul at Sydney, New South Wales:

> The semaphore system of signaling is principally used, every station and junction having home and distant signals. Interlocking systems, similar to those in use in England, are adopted at all stations on the main suburban lines and on the principal country lines. A special arrangement for interlocking is employed at sidings where no one is in charge. When the sidings are not in use, the main line signals indicate that the track is clear and the levers of the apparatus are locked up so that they cannot be tampered with. Conductors requiring to switch on to the side track are provided with a key to unlock the apparatus, and they must then fix all necessary signals before they can open the switch. When the switching is finished the conductor must close and fasten the switch before he can lower the main line signals to show "track clear," and these signals must be lowered before the key can be taken out of the lock of the case which covers the levers. At small sidings, which can conveniently be switched by trains carrying the time staff, fixed signals are used. All sidings in direct communication with the main track are provided with either stop blocks or safety switches, to prevent cars from being moved or blown along, so as to foul the main track.

BRIDGE TRACKS.

In laying a railway track over a bridge, with the ordinary open-floor system in use in this country, it should be well protected by guard rails, preferably large timbers, faced with iron, well bolted down and braced. The ties should be placed close together, with spacing blocks between, and well fastened down, so that in case of a derailment the ties will not be bunched together, and leave gaps for wheels or trucks to drop into. When at Sault Ste. Marie last year, just after the convention, I took occasion to notice the guards of the long railway bridge over the river. The guard rail proper is 8 ins. clear from the track rail; it is made of 6 x 9 in. timber, laid flat, boxed out 1 in. for the ties and faced with an angle iron; along the ends of the ties are 10 x 10 in. timbers, also boxed out for the ties. The guard rails flare out on the abutments, but the outside timbers end at the bridge portal. The Starrucca viaduct, which is a long, high masonry viaduct on the New York, Lake Erie & Western Railway, and which has no parapet walls above the track, has inside guard rails made of ordinary rails. Rerailing appliances should be placed on the approaches of bridges and trestles.

The best plan, however, is to build bridges with solid floors, to carry ballast, and make a continuous road-bed. This system is now being introduced on the New York Central & Hudson River railway, and I believe Mr. GEORGE H. THOMSON, M. Am. Soc. C. E., Engineer of Bridges of this road, has the honor of being the pioneer in introducing this improvement in this country. [See ENGINEERING NEWS, March 23, 1889.—ED.] The dead weight of the ballast and floor not only requires a heavier construction of the bridge, which in itself is an advantage, as tending to diminish the bad effects of the vibration caused by trains, but the ballast also serves to absorb the motion which causes this vibration. Of course the cost of the bridge is increased; but it is false economy to try to save a little in the first cost of a bridge, and the increased safety of the track and the greater durability of the structure should far outweigh any such considerations of seeming economy. A bridge on the New York Central, which may be taken to represent this system, has a series of transverse troughs, built up of plates and angles, the troughs being open at the top and bottom alternately. They are 16 ins. wide and 18 ins. deep. The ballast is filled into the troughs, and 8x8 in. ties are bedded in it, with about 12 ins. of ballast under the tie. Wooden blocks placed between the tie and the side of the trough prevent the creeping of the track. The arrangement can be varied to suit different cases, and for short spans, as at culverts, the troughs might be placed longitudinally. Solid iron floors are almost universally adopted in England, generally with an ordinary road bed of ballast and cross ties, but sometimes with wooden stringers under the rails and no ballast. Buckle plates are there very generally used for the floors.

REPORTS AND ACCOUNTS.

Reports on the construction and condition of the tracks of railways are of great interest and value, but are not generally easy to obtain. Some of the Railroad Commissioners' reports, in the returns furnished by the companies, give particulars of the track. In construction and in maintenance careful records should be kept and tabulated, to show work done, time occupied, cost, etc. In his report to the Louisville & Nashville Railroad Co. in 1875, Mr. ALBERT FINK, M. Am. Soc. C. E., then Vice-President and General Superintendent of the road, recommended the adoption of a complete and uniform system of railway accounting. The accounts of this road were kept at that time on the system recommended, and the department of "Operating Expenses" gave details of the cost of track work, maintenance, and repairs prepared from the records of the various officers. The report contains some very interesting matter on the subject of track work.

STREET RAILWAY TRACK.

As supplementary to railway track this subject may be briefly considered, especially as such considerable improvements have been made by the introduction of iron substructure. The old and still very generally used system, with flat rails of side-bearing or center-bearing section, spiked to wooden stringers which are laid on wooden cross-ties, is a very objectionable system for city streets; the rails have little vertical stiffness, and under heavy street traffic the stringers are crushed and the spikes loosened, so that the rails work up and down with every passing load, and in wet weather spurt the mud in all directions. In Europe iron and steel track on a concrete foundation is the approved form of construction, and is probably the track of the future for the cities of this country; but until the streets have proper foundations, and are properly paved and maintained, railway companies will not care to expend large sums of money on an improved track. The rails used with the metal substructure are of three general types of sections: 1, the girder rail, which is an adaptation of the ordinary railway rail, and is laid directly on the concrete foundation or on metal longitudinals or cross-ties bedded in the concrete; 2, the flangeless T rail, the web of which rests in iron chairs; and 3, the saddle rail, which is also carried on iron chairs placed at intervals. All of these sections have in various systems been adapted to American practice. Girder rails and T rails, with heads of different forms, are a specialty of the Johnson Company. So far the grooved rail has not met with much favor in this country; principally for the reason that it is advantageous only with a good pavement, and would effect no improvement where deep ruts are allowed to exist outside the rail, which is the present condition of the average city street. It is claimed that the groove would clog up and would require cleaning out, which would involve an additional expense. When the time comes, however, that the main streets, at least, of important cities are properly constructed and maintained, then the use of the grooved rail should be enforced by municipal ordinance, and it would probably be found that there was little more trouble than in other countries where these rails are used, while any expense for cleaning would be offset by the reduced cost of maintenance. On the Beacon St. line of the West End Street Railway Co., Boston, Mass., a heavy grooved-head girder rail is used, which was designed by Mr. THOS. DOANE, M. Am. Soc. C. E., and was made in England to his plans. It resembles the English girder rail. It is 7 ins. high, with a bottom flange 6 ins. wide, and a head 3¾ ins. wide. It weighs 99 7/12 lbs. per yard. Mr. DOANE states that there is a difference of opinion as to its success. The only objection is that there is a liability of the groove to fill, and it costs something, though little, to keep it free. It is, perhaps, unnecessarily heavy for horse or cable cars, which are light loads; but now the West End Company is running electric motors, which are much heavier, it is found that the ordinary tracks are not strong enough, while this girder rail will carry the traffic very well. It offers no resistance to the crossing of carriage or wagon wheels, and remains in good line and surface after nearly two years' service.

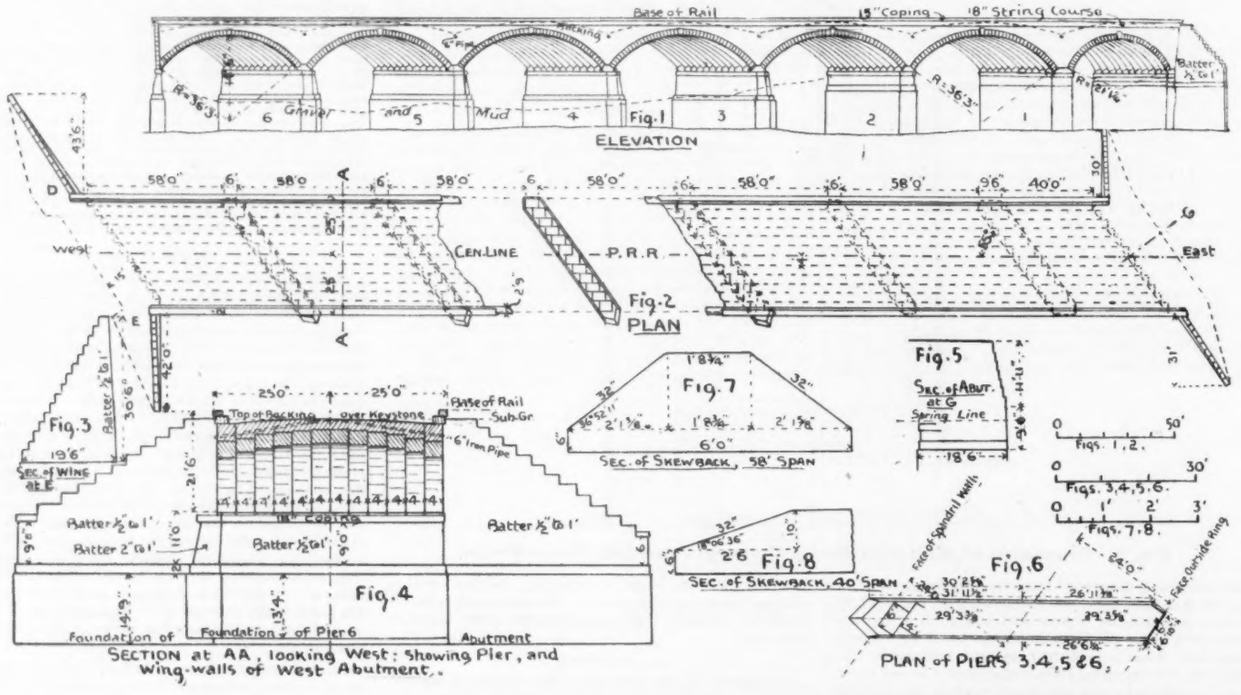
A very substantial track was designed by Mr. EDWARD WILSON, M. I. C. E., for the tramways at Southampton, England. The rail is of steel, weighing 55 lbs. per yd. and is of the flangeless T section. It is 3 ½ ins. wide and 3 ⅝ ins. deep. The web rests in cast-iron chairs with a flat base of 12x16 ins.; the upper part is 8 ins. long and the same width as the rail head. Chairs of extra length are used at the joints, and each pair of chairs is connected by a tie rod. The rails are secured by taper steel cotters passing horizontally through holes in the chair and the web of the rail; this fastening prevents any vertical motion of the rail.

A rail has been designed by R. T. WHITE, of Boston, which is a compromise between the American side-bearing rail and the English grooved rail; the lower flange of the former being inclined upward to form a wide flaring groove. It is intended for city lines, and is more easily crossed than the ordinary rail. It is of saddle section, secured by horizontal bolts passing through rail and chair. A rail with a groove on each side of the tread, and another grooved rail with the guard lower than the tread, are made by the Johnson Company for use with the prevailing style of paving. The Providence girder rail is about 7 ins. high, with the base keyed in a dovetailed groove in iron chairs. Tie rods hold the rail together. The head is flat, 2 ins. wide, but the paving between the rails is 13-16 in. below the top of the rail, the outside paving of course being flush with the rail. The chairs rest on a concrete foundation.

Improved switches, operated by the horses or the car, have been very generally adopted, but the crossings are usually of a very crude type, hard on the horses and the cars, and unpleasant for the passengers. In many cases the rails are merely cut where they meet, and a gap left at which the wheels batter the rail ends in a barbarous manner, while at such crossings the rails are often quite loose. A track crossing designed to give a smooth and easy passage to the cars was brought to my notice a few years ago, in which the principal feature was the gradual elevation of the lower flange or the bottom of the groove of the rail, so as to just reach the wheel flange, the head of the rail being depressed. While excellent in theory, and working well in miniature, yet in practice the wear of the crossing by heavy wagons, etc., and the wear and different depths of the car wheel flanges, would probably soon have impaired its efficiency in service, and nothing has been done with it, I believe. The Johnson Company manufactures a girder rail crossing with filled grooves; and certainly, with good street pavements and good street railway tracks, some improved form of crossing will be a necessity.

The Johnstown Ribbed-Arch Bridge.

While the incidents of the Johnstown disaster are becoming ancient history to all, except those immediately interested in that section and in the survivors or the victims of the flood, engineers will doubtless be glad to know just what kind of a



The Ribbed-Arch Bridge, at Johnstown, Pa., that withstood the floods of May 31. From plan filed in the office of the Penna. R. R. Co

bridge it was that withstood the fury of a flood that in its upper path swept away masonry structures that had stood the test of years and were models of good work. By the courtesy of an officer of the Pennsylvania Railroad Co., we here give a reduced copy of official drawing No. 3,002, which shows the bridge as built in 1887-88.

A press of other matter has delayed the appearance of this plan, but as it is of engineering interest as a plan aside from its notoriety, no special apology is necessary. The drawing leaves little room for a detailed description, other than to say that the material used in construction was the ordinary mountain sandstone, laid in cement mortar. Its preservation was due to honest work and materials rather than to any peculiarity of design, though its width of 50 ft. with spans of only 58 ft. made it an unusually "stiff" structure. It is only fair and proper to say, in this connection, that the contractors for the bridge were Messrs. Sparks & Evans, of Philadelphia, and the cement used by them in their mortar was the ordinary "Union" brand of cement as made by Lesley & Trinkle, of Philadelphia; and both of these firms have just cause

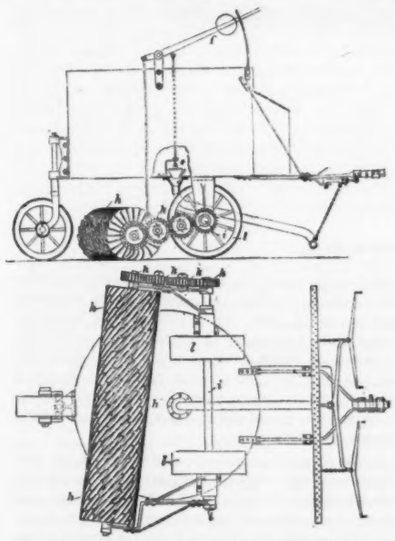
to take pride in the work and materials that have successfully stood a test as severe probably as ever stone and mortar were before exposed to.

The American Engineers Abroad.

(From our special Correspondent.)

Street Pavements and Trams.—The engineers as a body have virtually dissolved, and your correspondent finds himself in the German capital, inspecting its municipal works, collecting data relative to the harbors on the Baltic and North Seas, and visiting public works.

In this letter attention will be given more especially to the superior condition of the pavements, in all of the cities visited, over those at home. They include such places as London, Paris, Berlin, Edinburgh, Glasgow, Dublin, Newcastle-on-Tyne, and many less important points, yet everywhere the excellent pavements were an impressive lesson to the engineer. The "Belgian" block is found in many forms and sizes and laid in various ways, but with great regularity as to surface and with no ruts or holes. Upon steep grades, tram stones are to be found on the streets of Scotland for the wheels or



The Hercules Street Sweeping and Sprinkling Machine, Berlin.

for skids or shoes. The general excellence is due to the foundations being first laid either on a well compacted macadam surface, or better, upon a concrete base of from six to eight inches depth. The wooden blocks now largely used on the most frequented streets of London and Paris are well bedded on a similar foundation, and the sheet asphaltum is also laid on a concrete base to within a few inches of the surface. The latter makes a very smooth hard surface and is generally used, although in wet weather it becomes so slippery that at every footfall the horses slide and can get no grip. They seem, however, to adapt themselves to it, and seldom fall. In making a short stop they will often "squat" on their haunches and slide. The absence of longitudinal ruts beside the car-tracks is also noticeable. This is due to the form of rail used, a sketch of which has already been sent to the NEWS. This form is well-nigh universal, and offers no inducement to truck-drivers to follow the trams and no obstructions to crossing or turning out. There is hence less wear on track and less driving in certian definite lines.

In this city the system of track-laying has reached a high stage of development. There is first a bed of sand, next one of concrete about 3 ins. thick upon, which is laid a heavy grooved girder rail with a broad bottom flange. The rail is about 6 ins. high, weighs 100 lbs. per yard, is 30 ft. long, and has bevelled joints of 45°, united by fish plates with 4 slotted holes to permit of expansion. There are 4 iron ties ⅛ x 2 ins. to every pair of rails. The joints are opposite. After these rails are carefully aligned and levelled, a grouting is poured under them in a trench made by sand banked along either side and afterwards removed. The pavement is then filled in with a concrete composed of cement and coarse and fine gravel about 1 to 7 parts to within 2 ins. of grade and completed with asphalt.

In Paris the streets are generally watered by a movable hose, consisting of an articulated pipe mounted on castors like a centipede. The "plugs" are below the level of the curb and covered by an iron plate so as to offer no obstruction to passage. With this flexible tubing the attendant can reach a large section of the street, but his hose excludes carriages and is often a serious obstruction. Iron tanks are in general use elsewhere. The streets are swept early in the mornings, usually by machinery working towards the gutters, and the sweepings are then either collected in barrows or wagons, or flushed into the sewers. One of the best sweepers is the Hercules, of which drawings are inclosed. It puts a polish on a stone pavement and is a simple as well as very efficient machine.

Pipes and wires are often laid under the sidewalk where there is one, but the pavements are so excellent a substitute that the former are frequently ignored by pedestrians who crowd the streets at the risk of serious accidents. In London alone there are said to be over 20,000 hacks, exclusive of omnibuses and other vehicles. In Paris about 13,000. There the omnibuses often have three horses abreast and are very heavily built, double-decked, carrying about 24 inside and 20 out. The tram cars in some cases had flanges only on the two wheels of one side and seemed to track very well. Many other features might be noticed, but time and space forbid. These hints contain suggestions which our municipal engineers and others may find of some service.

L. M. HAUPT.

BERLIN, July 1, 1889.

The St. Louis Sampling and Testing Works.

The above-named works were lately visited by one of our correspondents, and would seem to be from his description one of the most complete and best equipped establishments of its class in the country. These works were erected for the especial purpose of ascertaining, by actual working tests on a large scale, the average value of ores, the best and cheapest method of treating them and the commercial results to be expected from them. In a list of the materials constantly requiring chemical examination to prove their value and usefulness we find under the head of iron and steel works and iron foundries, the metal, the ores, fluxing material, slag and cinders, fuel, graphite, moulding sand, the refractory materials like fire sand, clay, brick and ganister, and finally the analyses of the various gases. When we add to these the long list of articles requiring a similar examination that are included under the reduction of lead, silver and copper ores; articles entering into generally used railway plant and the maintenance of railways, gas-works, textile fabrics, porcelain and glass works, food and chemicals, there is evidently abundant work for an establishment such as is here organized, and the wise man will take advantage of its facilities.

A description of the plant and methods adopted for analyses by this company would occupy too much space, even were it essential or useful in this place. It will be sufficient to say that there is an excellent equipment of testing machines for obtaining the properties of wood, metal, stone, brick, lime, cements, etc.; a specially arranged boiler plant for accurately testing the steaming qualities of fuel, and, of course, a thoroughly equipped physical laboratory. The works have been in successful operation for a year and a half. They are located at 1225 and 1227 Spruce St., St. Louis, Mo., and Mr. W. B. POTTER, E. M., the Manager, will doubtless furnish any further information required.

Componential Trusses for Traveling Crane.*

During the past winter there was constructed at the marble yards of Messrs. John Baird & Sons, Philadelphia, an iron trestle, complying with unusual conditions. Since its design possesses some peculiar features of engineering interest, the following description is submitted to the members of the Society.

The marble yard mentioned is located on the Schuylkill river, just south of Walnut St., and extends from 24th St. to the wharf line, a distance of about 350 ft. It has on 24th St. an extensive saw mill, and the yard space between the mill and the river is used for the storage of blocks of marble. These blocks are conveyed from the river, and distributed over the yard or carried into the mill, as the case may require, by a traveling crane which moves on two elevated rails, one at each side of the yard.

When the Baltimore & Ohio Railroad extended its lines into the city of Philadelphia, it crossed Messrs. Baird & Sons' property, and threatened to seriously injure their business by separating the mill from the yard. The elevation of the grade of the railway was such as to permit of only 2 ft. 5½ ins. for the depth of any overhead structure, while the width of the right-of-way to be spanned was over 60 ft. At that time, shallow box girders were constructed, carrying the stringer and the elevated rail over the right-of-way, and by this means the traveler was permitted to pass from the yard into the mill.

After the railroad had been in active operation for about two years, however, its yard room adjacent to Chestnut St. Station proved insufficient for its increasing business, and, in order to reach additional tracks south of Walnut St., it was proposed to increase the width of the right-of-way across the yard to 100 ft, and to support the elevated tracks over the railroad, as before, on iron girders. The maximum allowable depth of 2 ft. 5½ ins. with a clear span of 100 ft. made the problem a serious one. The shape of the traveler, extending 12 ins. beyond the rail, rendered the use of a deep girder, outside of the stringer, objectionable on account of the lateral moment produced. The construction of the mill was such to prevent the further elevation of the track; and the required clearance beneath, with a proper limit of deflection, made the use of a deck girder, as before, impracticable.

The plan adopted, as promising the most satisfactory results with the greatest economy, was the one herein described.

The general design was such as to place the supporting girders entirely outside of the stringers, and at the same time to provide for all lateral moments produced in the structure. In detail, the vertical load was resolved into two components—horizontal and oblique—and these components were each carried by a web system. The oblique system was of sufficient depth to give vertical stiffness to the truss, and was placed at such an inclination as to avoid the end of the traveler. The horizontal system was so constructed that its outer chord would come directly under that of the oblique system. These componentia web systems were united at their apex by a common chord; and their remaining chords, on the outside of the truss, were in turn united by a vertical system. Thus was constructed a truss with three chords and three web system, the componential systems carrying the live and dead load applied at their apex, while the vertical system carries the dead load applied at its chords. The top and bottom chords of the vertical system act as the chords proper of the truss, while the chord at the apex, under the applied loads, serves to transfer the strains from one componential system to the other, and at the same time acts as a stringer to carry the live load between panel points.

The horizontal and vertical systems are made of riveted lattice, since they require no adjustment, and their construction of riveted work was considered economical. The horizontal system is provided with counter diagonals in each panel, and was designed to resist all counter strains produced in it by the live load; the vertical system, however, which carried only dead load, does not provide for counter strains, and each panel is therefore constructed with but a single diagonal.

The diagonals of the oblique system are square rods with sleeve nuts, which permit the proper adjustment for camber and rigidity. By this arrangement, it is practicable to carry the live load strains through the componential systems, as designed, and allow the vertical system to carry only dead load. The proper adjustment of the rods in the oblique system will relieve any counter strain in the vertical system which might occur on account of undue deflection under the passing load.

While the treatment of the strains in the three web systems was essentially theoretical, a close examination of the vertical system during a passing load fails to reveal any tendency in the diagonals of that system to resist counter strains. This conformity with the theoretical assumptions may be attributed to the adjustment in the oblique system.

The erection of the trusses was not a difficult matter and involved no unusual features. The old girders were removed from their bearings, lowered slightly, and placed on piles of marble. On these girders was constructed a skeleton platform, and on this platform the new trusses were assembled and riveted together. They were then lifted at the ends and swung into position.

The original design of the trusses provided for a span of 106 ft.; but the required width of right of way was subsequently changed by the railroad company, and, in consequence, the trusses were constructed 87 ft. 7 ins. between centers of columns. The depth of each truss, from out to out of chords of the vertical system, is 8 ft. The width is 4 ft. between centers of the chords of the horizontal system. The depth from base of rail to clearance beneath is 2 ft. 4½ ins., including a 6-in. wooden stringer.

*Read June 21 at Convention of Am. Soc. C. E. By HENRY B. SEAMAN, M. Am. Soc. C. E.

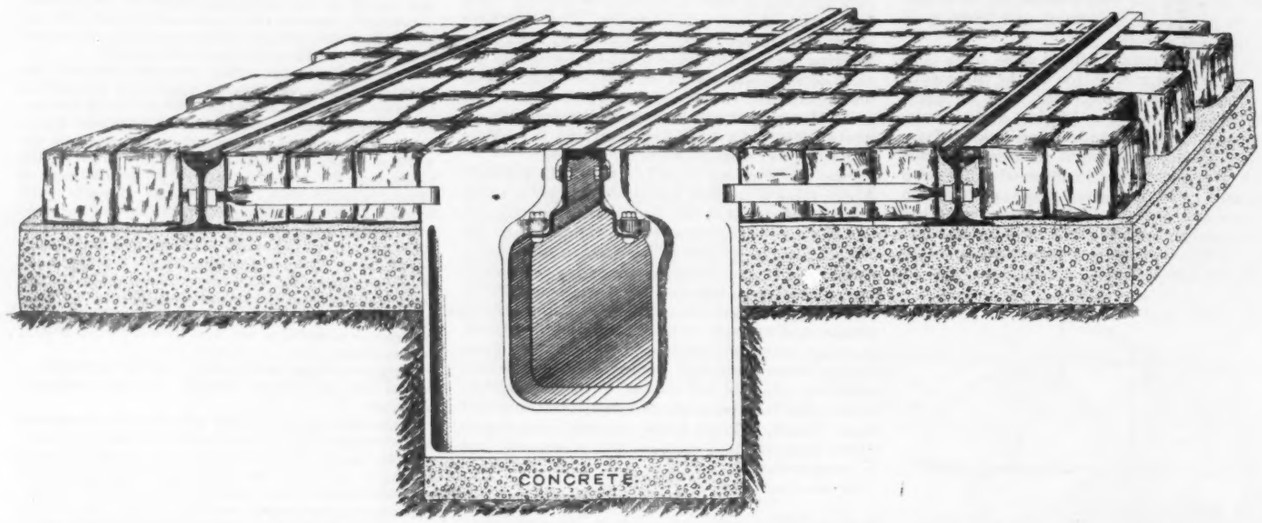
The design of the trusses being novel, their unusual appearance elicited considerable criticism, and during erection prophecies of failure were freely made. It seemed much easier to explain why they must fail than to understand how they could succeed. The light vertical system and the upper chords were the particular objects of criticism, while the stringer itself apparently had no support. Subsequent developments, however, quieted these apprehensions. The trusses were designed to carry a load of 15 tons on two wheels 6 ft. apart, and the first load to which they were subjected was one of the old girders weighing 14 tons. This was carried close to one of the trusses, and with the weight of the traveler was probably fully equal to that for which the trusses were designed. The result of this test relieved all further anxiety as to their efficiency, and the structure has since continued, under constant use, to give entire satisfaction.

was, however, for ten tracks, with the four upper tracks left off at the start.)

	Tons.
For the middle span (2,850 ft.)	18,000
For the two side spans, including the anchor trestles (1,500 ft. each)	20,400
Two towers	13,700
Anchorages	3,400
Total	56,200

Of which 22,000 tons (or about 3.8 tons per lin. ft.) is for steel wire in the cables between the anch o

It is not necessary to expatiate on this point to bridge engineers; but suppose that the Brooklyn Bridge superstructure should have been built on the amateur principles of strength enunciated by the critic. It could be shown that its massive stone towers, as built, would be in danger of crumbling down, and that the existing anchorage abutments would be in danger of overturning on their foundation, and that, besides, the cost of the bridge would have been more than double.



Cable Conduit Built in 1887-88 for the Edinburgh Northern Cable Tramways.

A Reply to Certain Criticisms on the Proposed North River Suspension Bridge at New York City.

BY GUSTAV LINDENTHAL, MEM. A. S. C. E.

The London *Engineer*, issue of May 17, 1889, contains a criticism by Mr. MAX. AM ENDE of the plans for the North River Suspension Bridge at New York City. It came to my notice but recently, and pressure of work prevented my giving it earlier attention. The critic's inexperience and lack of essential knowledge, as disclosed in said article, are somewhat surprising, and I should not consider it worth a reply, if it were not for the fact that some of the readers of the London *Engineer* are not bridge experts, and that the critic presumes to speak with a claim to competency.

The one point which apparently furnishes Mr. AM ENDE with a justification for his suggestions, and which forms the gist of his article, is the quantity of metal for the bridge, and the alleged lack of economy therein. We are aware that saving of iron or steel *per se* does not always mean economy, because the prices for different construction may vary greatly; but waiving this distinction, as too inconsequential on this occasion, we will examine briefly his statements concerning the total quantity of metal required in the proposed suspension bridge for six tracks.

Mr. AM ENDE figures out in a manner which he states, the weights in the suspension bridge as follows:

	Tons.
Weight of large span (2850 ft.) about	108,500
" of two side spans (1,500 ft. each)	114,200
" of the towers (450 ft. high)	32,000
" of anchorages	22,600
Total about	277,300

of which about 193,800 tons, (or 32.29 tons per lineal foot) is the quantity of steel wire estimated by Mr. AM ENDE.

The weights, subdivided in like manner from our original design for six tracks, are here given. (The described design, as had been specially mentioned

ages. This is only about one-ninth of the weight of wire required by Mr. AM ENDE, and the total weight of all metal is only about one-fifth of his. At the prices ruling here, his suspension bridge would cost about $60,000,000 against $14,000,000 for our design. How is such an extraordinary discrepancy possible? Plainly, it indicates more than mere error: it indicates, of itself, ignorance of the most essential elements of the design. An examination of the premises on which the critic has built up his conclusion will show this.

1. The critic assumes that steel wire, suitable for bridge cables, cannot be had of greater strength than 50 tons per sq. in. Mr. AM ENDE may have heard of the existence of the great Brooklyn Suspension Bridge, at New York City, but it is not probable that he has ever heard of the specifications for the steel wire in that bridge, or that he has acquainted himself with the method of making the cables. For, if he had, he would never have written what he did. He would know that the No. 7 (Birmingham gauge) steel wire for the bridge had an average strength of 85 tons per sq. in. and that it was not less than 82 tons, although the minimum of the specification was 80 tons. That was twelve years ago. Such wire will bend cold to a loop around its own diameter. It can be had now at less than half the price at that time. Mr. AM ENDE could easily have obtained information on the strength of steel wire almost anywhere. Ignorance of it is inexcusable in an engineer, and unpardonable in a critic.

2. After assuming 50 tons as the ultimate strength of steel wire, the critic assumes 10 tons as the admissible working or unit strain. Of course, he does not know that the admissible working strain in the cables of the Brooklyn Bridge is about 21 tons per sq. in., nor is he aware, as he should be, that the cables were made with such care and skill that the normal difference in the straining of the 6,300 wires, composing one cable, is less than 1 per cent., and that a high working strain is justifiable for a wire cable, as proposed.

But still worse, Mr. AM ENDE has apparently not advanced beyond the most primitive notions of proportioning metal structures. Whether the span is 50 ft., 500 ft., or 2,850 ft.; whether the proportion of dead load to live load is 1 to 3 or 3 to 1; whether the strains are cumulative or in the form of a shock; or whether in tension or compression, it is apparently all the same to him; it is every time one-fifth of the ultimate tensile strength of the metal.

What are the facts? As the bridge stands, its cables can be strained to the assumed working strain of 21 tons per sq. in., or to one-fourth of their breaking strength, only if a mass of humanity, equal to an army corps of 34,000 soldiers with their accoutrements, should be congregated on the suspended structure 3,400 ft. long. Such a load would be extremely rare; it could not be brought on the bridge without special discipline.

In the six years of its use, there have been tremendous crowds, without restriction of any kind, on the Brooklyn Bridge on different occasions, creating, at one time, a panic in which over a dozen people were crushed to death, but not once has the live load reached one-half of the maximum assumed for its calculation.

It does not require the attainments of an engineer to understand that bridge cables of long spans, which are not likely to be strained to the maximum of one-fourth of the breaking strength once in 30 years, are safer forever than girders 50 feet long which are strained to one-fifth of their breaking strength several hundred times a day, namely, every time a locomotive passes over them. Still the critic apparently knows no distinction. He would have a weak steel wire of 50 tons strained with 10 tons in tension for the cables; he would have an erect steel arch with 8 tons per square inch in compression; because, forsooth, the steel would have a tensile strength of 40 tons; and he would have the same in the floor girders and in the suspenders, and all other parts of the bridge. Further comment on this point is not necessary.

3. Next come the live loads. Mr. AM ENDE assumes one ton per lineal foot per track, probably because it is the English standard for ordinary railroad bridges. Therefore, as he does not know better, he uses it also for a 2,850-ft. span of six tracks, resulting in about 17,000 tons for the middle span alone. How such a load could ever be brought on the bridge, except for the sole and extraordinary occasion of testing, he did not explain.

On page 59, ENGINEERING NEWS, 1888, maximum loads are given, one train 1,500 ft. long on each track. To bring such a train on the bridge over the steep approaches would require two heavy locomotives and half the cars empty. The conjunction of six such trains would be an extraordinary event, not likely to happen once in 30 years, particularly as the greater part of the traffic is to be from passenger trains. Six such unusual trains would weigh 9,000 tons.

Half the maximum load will be a rarer occurrence than on the Brooklyn bridge, which, as already shown, has not had it yet during its existence. One quarter the assumed load, may happen, perhaps once a year; one eighth, perhaps once a week; and about ten per cent. of the maximum load perhaps once a day, from probably 1,200 trains over it daily.

The bridge is not intended for use as a storage yard for loaded freight cars, as the critic may think, to judge from his assumed live loads; but should it ever happen to be the case, or worse yet, should the bridge be ever entirely covered with locomotives on all six tracks from anchorage to anchorage, 5,850 ft. long, even then the strains in the cables would be within the elastic limit of the steel wire and the effect on the bridge would be absolutely harmless. Almost any extraordinary earthly or celestial event is more likely to happen than the assemblage of 600 locomotives on such a bridge.

4. The foregoing remarks sufficiently indicate the critic's unfamiliarity with the most elementary principles of design for wire suspension bridges and for long span bridges; but there are other points he names which confirm this impression. Take for instance his statement: "The quantity of material used during the erection, and removed after completion, is smaller in a suspension bridge than in an arch bridge." Indeed, a very safe statement, but how much smaller? Is it 1-10 or 1-1000 or 1-10000 of the quantity for the erection of an arch bridge? As the critic has evidently never seen the erection of a suspension bridge, he probably cannot tell. He may be surprised to learn that, with the exception of a few suspended wooden platforms, worth a few hundred dollars, it does not take any extra quantity of material for erection; for the wire cables used for a temporary foot-bridge over the towers can afterwards be used in the wind cables.

Take again his observation "that the friction cannot be determined from the beginning, and may be very great, and therefore its uncertain effect on the strains in the suspended structure and bending strains in the towers." Of course, Mr. AM ENDE knows nothing of the experiments on rolling friction, made, for instance, by the late C. SHALER SMITH on drawbridges, or of the experiments for the roller bearings under the cable saddles of the Brooklyn Bridge, or he would know that the effect is less than one per cent. of the pressure on the towers and less than 2-3 per cent. in the tension of the cables. As for bending strains in the towers, he does not appear to know that it is part of their legitimate work, for which they must be designed. He might as well object to the bending strains in a bridge girder from railroad trains.

5. These, as well as other questions, have been discussed in the description of the bridge (pages 57 to 226 ENGINEERING NEWS, 1888), such as relating to the shearing strains in the arches from end bending moments, and the means provided for their avoidance; the rigidity of suspension bridges, as compared with other systems, etc. It is not necessary that they should be recited here. Whatever had not been specially mentioned in that description had been assumed to be known as old and established. There is not a bridge engineer in this country who is not familiar with the existing wire suspension bridges, and particularly with the excellence of workmanship in the large wire cables of bridges built by the ROEBLINGS, father and son, and by other engineers of their school. The improvements aimed at in the construction of still larger cables had been stated, and need not be repeated here. Not a single essential feature for our design can be anticipated that has not been already investigated and provided for in such thorough manner as the critic may not be aware of, and as the novice he shows himself to be on wire suspension bridges could not have suggested. There has appeared as yet no reason for a change of our opinion (on page 174 ENGINEERING NEWS, 1888), that the suspended braced arch, formed of wire cables, is the most economical type for very long spans where anchorages can be had on rock; naturally, it is assumed, if designed by a competent engineer.

5. Mr. AM ENDE is excusable for bringing forward on the plea of economy, as he understands it, a suggestion for an erect arch bridge, though he may by this time be convinced of its entire uselessness. Nevertheless, the way he does it is likewise characteristic of the critic's idea of economical engineering. It is not necessary to indulge in comparisons of our systems of construction and manufacture with his remarkably heavy and costly details, as illustrated in *The Engineer*, London, but we shall merely indicate his neglect of a primary question.

MR. AM ENDE could not be ignorant of the depth below water of his arch abutments, namely, about 75 and 175 ft. respectively (depth given on page 57, ENGINEERING NEWS, 1888). Add 50 ft. above water for height of skew-backs, and the leverage against overturning from the thrust of the arches would be 125 and 225 ft. respectively. The great expense for the masses of submarine masonry required would form a very essential part of the total cost, and would be the controlling question of the design. But remembering the fact, which the critic ignores, that the clear height from 140 to 150 ft. above water must be maintained from pier to pier, so that the skew-backs for the arches would have in truth to be at least 200 and 300 ft. respectively above the foundation, the absurdity of an erect arch bridge becomes apparent. It does not appear to him very material that the arches of the Douro bridge and of the Garabit viaduct, which he mentions, rest against rocky hillsides, which, with little expense, furnished the required abutments. The critic appears serenely oblivious to this decisive condition for the total cost of the bridge, but, instead, informs us of what he considers of importance, namely, the detail for the arch footing, of which he had not indeed "determined yet by calculation whether it should be a cylindrical pivot or a narrow flat bearing," comparatively a most trivial matter. It is superfluous to show that the masonry masses for an arch bridge planted in deep water would be much more costly than for the suspension bridge.

6. The critic's arrangement for the shore spans and the method of erecting the arches, resembling that of the St. Louis arch bridge (of which probably he knows likewise nothing, since he could have made his description of the erection shorter and clearer by referring to it), would necessitate the tearing down of costly property, a fact indicated on page 226 ENGINEERING NEWS, 1888, and one which has also great bearing on the total cost of bridge, as well as on the choice of the suspension bridge, since it requires no false works of any kind for the erection either of the side or middle spans.

7. From the foregoing the competency of the critic for the subject he chose to examine may be judged, also the correctness of his conclusion, namely: "The writer has no hesitation in saying that the investigation has produced results more favorable to the arch than anticipated, and he cannot help thinking that if Mr. LINDENTHAL had entered upon the same line of argument as the writer he would have obtained similar results." To which we observe that never before have we read a discussion or criticism of which the writer showed such a great lack of essential and rudimentary knowledge; such poor judgment of the broad and controlling conditions of a given engineering problem, and of the essential and non-essential elements for its solution, as the critic betrays in his effort. We cannot help feeling surprised at his presumption that we failed to anticipate a simple investigation of his based on the elementary principle that the quantity of material in the arch flanges is approximately and inversely as the deflection of the arch. We should like to know what less an engineer could do in the case in hand?

The critic's outfit for designing long spans would evidently be simple: a text-book on arches, a working strain of one-fifth of the tensile strength for all metal parts, tension or compression, a multiplication table for his live loads,—and he would produce a little arch for a little bridge, and a large arch for a large bridge, foundations or no foundations. One method would do for all, very much like the country doctor who had one prescription for all sorts of sickness: whether pneumonia or rheumatism, toothache or malaria, typhoid fever or dropsy, it was a dose of calomel every time,—a little dose for little pain, a large dose for great pain.

If Mr. AM ENDE does not see his suggestions received with as much appreciation as he himself may think them worth, we ask his pardon for having stated a few of the reasons therefor. His last question, "Why do engineers direct their inventive power to making foundations of unprecedented depth instead of spans of unprecedented length?" is not surprising from one of so little reading and general information. Otherwise he would be aware that there was no foundation in any river or estuary, and of any depth, for which, as the occasion arises, several American contractors would not submit their bids, and guarantee successful completion, because it has already been done in competition with contractors from England and other parts of the world.

The Edinburgh Cable Conduit.

In the letter of Prof. L. M. HAUPT, in our issue of July 6, reference was made to the new cable road lately put into operation in Edinburgh. We now give an illustration showing the novel form of conduit adopted and also the very substantial method of laying the road-bed.

This illustration is furnished by the firm of Dick, Kerr & Co., of London and Glasgow, and the engineers and contractors for the road in question. The yokes are rectangular castings, about 2 ft. square, resting on a bed of concrete and spaced about 4 ft. apart. The conduit itself, between these yokes, is made of concrete. The slot-rails are made of steel and weigh 40 lbs. per yard; they are peculiar in form and known as "Colam's patent."

The grooved rail is also of steel 7 ins. deep, and weighs 90 lbs. per yard; or, with fish-plates, bolts, and nuts and tie-bars, 149 tons per mile. Under the rail is a bed of concrete, 6 or 7 ins. deep, covered with about 1 in. of sand.

This conduit, while simple and economical in cost, is said to give very good satisfaction. Its good features are probably due in great part to the substantial character of the entire road-bed, which may be classed as a model of this type of construction.

The effort made to preserve a smooth street surface, with little or no obstructing rails or slots, is especially marked. While the first cost of laying this conduit and track is not given, a glance at the illustration will show that this first should be practically all the cost, as there is little or no chance for the later tinkering and repairs that in our own country swell the annual maintenance account. The smoothness and solidity of a track laid as this is should also have a very material effect upon the reduction of wear and tear in the rolling-stock,—an effect that, if properly weighed in dollars per term of years, would go far towards pointing out the false economy of a cheaply laid and rough road-bed that is always in need of renewal.

North China's New Railway.

The British Consul at Tien-Tsin, in his last report, gives some interesting details respecting the new railway in North China, between the Kaiping Mines and Tien-Tsin, which was completed last summer, and is now open to traffic throughout. It is 85 miles long, and the average cost was $20,700 per mile. This includes all rolling stock and engines, and a considerable sum spent on stations, wharves, etc. Rails have come from Bolckow & Vaughan, with the exception of 600 tons of light rails from Krupp. Rolling stock is built on the spot from iron purchased chiefly in England. This system saves the heavy freight charged on bulky cargoes, and enables the company to make exactly what suits it best. The passenger cars, steel framed and teak, are 55 ft. long and carry more than 100 people. They cost complete about $2,680. One engine came from the United States; the others are English, built on the American system, which has proved itself the best for the rough roads laid with light rails. The American engine cost 20 per cent. more than the others, but she beats them in actual performance, the details of working parts being better Steel fire boxes are found to last longer and give less trouble than copper ones, though the engines only run about 200 miles without being cooled for washing out. The water along the line is very salty. So far the company has always purchased in England through its own agents, which it finds a more satisfactory proceeding than dealing through firms in China; but in view of the possibility of tenders being asked for, rail makers would, the Consul thinks, do well to appoint local firms as their agents, and establish proper code systems in order to cheapen and facilitate telegraphing. The rails used by the present company are invariably of Sandberg standard sections, 45 lbs., 60 lbs. and 70 lbs. per yd. being the sizes employed.—*London Times.*

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Drawings for publication *should preferably be in plain black and white, considerably larger than they are expected to appear, with letters and figures in pencil only, all lines clean and bold.*

Coming Technical Meetings.

Association of Civil Engineers of Dallas, Tex.—Regular monthly meeting, August 2. Secy., E. K. Smoot, Elm and Austin Sts.

National Electric Light Association.—A convention will be held at Niagara Falls, N. Y., Aug. 6, 7, 8. Secy., A. V. Garratt, 18 Cortlandt St., New York City.

New England Roadmasters' Association.—Annual meeting at Boston, Aug. 21. Secy., W. F. Ellis, Woonsocket, R. I.

Civil Engineers' Society of St. Paul, Minn.—Next meeting, Sept. 2. Secy., Geo. L. Wilson, City Hall.

Roadmasters' Association of America.—The annual convention will be held at Denver, Col., beginning Sept. 10. Secy., H. W. Reed, Waycross, Ga.

Boston Society of Civil Engineers.—Next meeting, Sept. 18. Secy., S. E. Tinkham, City Hall.

WE are in receipt of a letter from the Railway Lighting & Heating Company, of Philadelphia, referring to our editorial note, of July 6, on the late accident on the Norfolk & Western Railroad and the connection therewith of gasoline as present in the Frost carburetter system of car lighting. The letter of Mr. S. B. HAUPT, Superintendent of Motive Power, accompanying this communication, gives evidence that the fire originated from the fire box of the locomotive, as we suggested might have been the case. Mr. E. L. DU BARRY, the Superintendent of the Eastern Division of the same road, was in the wreck and in the one coach lighted by the system in question, and he states that the fire started 1 hour and 30 minutes after the first crash, and that sparks were slowly dropping from the fire box of the locomotive during the greater part of this time. Mr. HAUPT positively denies the "explosion" of the gasoline lamps, and as proof says that his company has in its possession, open to the inspection of every one, the five carburetters taken from the wreck. They are "considerably damaged," "the sides are dinted and the soldered joints shown to have been separated by the intense heat,"—which is all natural after passing through such a wreck and fire. But the letter also states that "the breakage of pipes may have allowed the gas to escape from the carburetters, which would contribute somewhat to the flames, but not as much, we think, as the breaking of the oil lamps and the scattering of the oil they contained." It is also stated that the air-reservoir connections might have broken—"in which case there could be no discharge of gas." From the statement of parties who were in the accident, all of the lights in the wrecked cars were extinguished instantly with the crash.

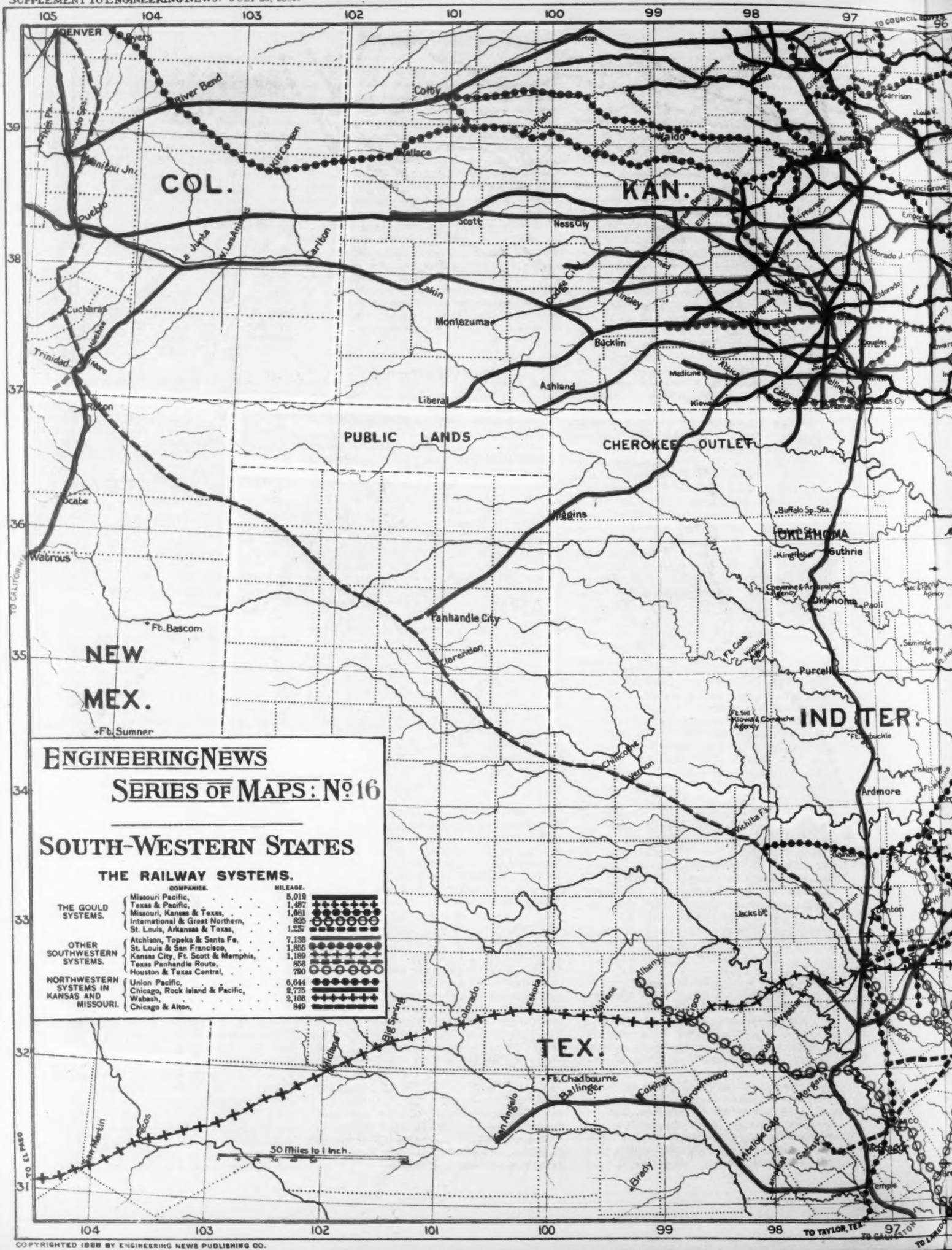
WE give this detail in common fairness to the parties interested in this new system of car-lighting, and freely admit that the evidence, though coming from strongly interested parties, is decidedly against the theory of a gasoline explosion having caused the fire as at first reported. But our correspondent also admits that his system "may have contributed somewhat to the flames," and it is this feature of the system that we originally deprecated and still object to. It is true that the breakage of oil lamps might have been almost equally effective in spreading a fire once started; but there should be no oil-lamps, just as there should be no car-stoves. Both belong to the "crude age" of railway transportation, and every man is interested, for himself and his family, in reducing as speedily as possible the dangerous features of travel, and it is ancient car-lighting and car-heating methods that have very generally been responsible for the horrible side of our record of past railway accidents. It is for this reason that we objected to the use of gasoline in any form, where life might be endangered, and pointed out the possibilities attending its use and general handling. We have no doubt that, as employed by this company, gasoline is as safe to use as it is possible to make it; but it is never absolutely safe, and is in this respect no advance upon the old-fashioned oil-lamp, so generally and properly objected to. We have no interest whatever in condemning this individual system, and are gratified that it can make so good a defence in the case of the late disaster; but we have an interest in demanding for every one using railways that objectionable methods should be supplanted only by more perfect methods, and that we should advance in our regard for the safety of the traveling public, rather than merely continue on a line that has already been shown to be dangerous.

THE papers have been filled the past week with news of a great railway trust scheme and conjectures concerning it. The simple facts are that Mr. J. J. MCCOOK of this city has proposed a plan for consolidating the railways of the country into a few great systems, and has sent out a circular letter to the leading railroad men and bankers throughout the country to call their attention to the scheme. The end which it is desired to attain is the avoidance of all competition. While in some features the proposed plan is commendable, any one conversant with the present state of public opinion must recognize that the formation of such trusts would be the signal for an avalanche of hostile legislation from whose action there would be no appeal. A second consideration sufficient to defeat the scheme is that, according to the best interpretations of the common law, such a trust would have no legal standing and the holders of its certificates might have their title to their property declared forfeited at any time. A necessary preliminary to the formation of any such vast consolidation must be the establishment of a definite relation between the railways and the State and National Governments, and a definite statement of the power of the Government to regulate the earnings and expenditures of the railways.

BOSTON, like New York, is worrying over the rapid transit question. But Boston, unlike New York, has a tangled mess of crooked streets and water-ways of all directions and widths to deal with, and the question of how to best thread this maze is naturally one of prime importance. A strong party advocates elevated roads, but seems to have no well defined idea of how they are to avoid making a nuisance of their project, twisting around through comparatively narrow streets, or how they can deal with the water-ways to be crossed. Another party advocates tunnels, low enough to pass below all the water channels, and the latter claim with some justice that their plan is the best for the interests of the passenger and the city. But from what we know of some of the difficulties encountered in the construction of the intercepting sewerage system in Boston, in the way of water, soft ground, and running gravel, the tunnel scheme, while possibly the most satisfactory plan when completed, will cost more money than some of its promoters figure upon before the tunnels can be opened to traffic. The high-level elevated scheme, before referred to in this journal, would seem to be well adapted to the conditions of the case in Boston. It is a radical departure from previously adopted transit plans; but it has the merit of avoiding crooked streets and navigable water-ways, and the further great advantage that it is all above ground and its cost can be estimated with a reasonable amount of certainty. A low-level elevated road should not be permitted at all, and the tunnel is a very uncertain scheme, as to cost, in the doubtful soil underlying the greater part of the city of Boston. The high-level project is worth careful study by the engineers of that city interested in the transit facilities.

THE rumor that the Brotherhood of Locomotive Engineers may unite with other employés of railway corporations in a general strike on Western roads is scarcely to be credited, and any movement in that direction would show a wide departure from the methods that until lately controlled this once powerful labor organization. It is true that this association lost prestige in the Burlington defeat of last year, and it is quite natural that they should wish to regain this lost ground. But their former power lay in the fact that the Brotherhood was a close organization of skilled workmen, who could not be easily replaced, and whose affairs were managed by a cool and able man, Chief ARTHUR, and it is as a brotherhood that they must again win, if win they can. To join issue with the greater mass of unskilled labor, labor that can and will be replaced, is to invite inevitable and lasting defeat, and the best proof of this is the fact that the proposition is opposed by their own wiser chief.

WE are pleased to see that, as suggested by our note in last week's issue, the city of Seattle has already taken measures to prevent any other such disastrous conflagration as that which recently swept over its business district. On July 1, the Common Council passed, and Mayor MORAN approved, an ordinance making regulations concerning the erection, alteration, repair, and use of buildings in Seattle. These regulations seem to be remarkably thorough and stringent; and so long as the people of the city see to it that the officer elected to enforce them is a man who will do his duty without fear or favor, and who is proof against the wheedling influences



ENGINEERING NEWS
SERIES OF MAPS: No. 16

SOUTH-WESTERN STATES

THE RAILWAY SYSTEMS.

	COMPANIES.	MILEAGE.
THE GOULD SYSTEMS.	Missouri Pacific,	5,012
	Texas & Pacific,	1,487
	Missouri, Kansas & Texas,	1,861
	International & Great Northern,	885
	St. Louis, Arkansas & Texas,	1,257
OTHER SOUTHWESTERN SYSTEMS.	Atchison, Topeka & Santa Fe,	7,138
	St. Louis & San Francisco,	1,855
	Kansas City, Ft. Scott & Memphis,	1,189
	Texas Panhandle Route,	858
	Houston & Texas Central,	790
NORTHWESTERN SYSTEMS IN KANSAS AND MISSOURI.	Union Pacific,	6,644
	Chicago, Rock Island & Pacific,	2,775
	Wabash,	2,108
	Chicago & Alton,	849

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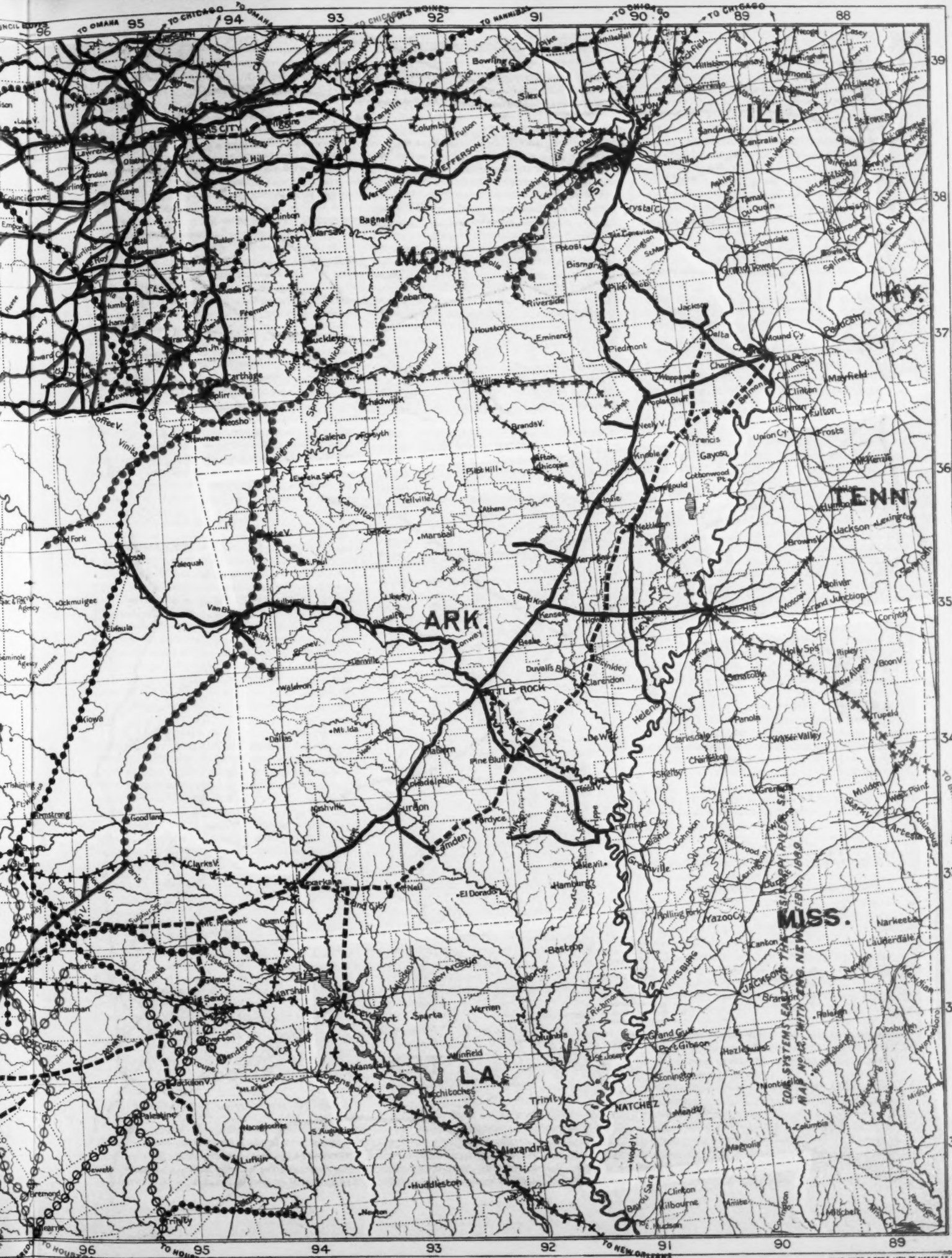
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TO DES MOINES
TO HANNIBAL
TO ST. LOUIS
TO HOUSTON
TO NEW ORLEANS
TO BIRMINGHAM
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of a carelessly exposed roll of bills, they may feel quite safe from perils by fire or fall of structures.

Among the excellent features of the regulations we note that bay windows are not allowed to project over the street line more than 3 ft., the bottom must be 13 ft. above the sidewalk, and they are forbidden entirely in any street less than 35 ft. wide. The one thing seemingly overlooked in this new departure is the regulation of obstructions to sidewalk travel arising from adjuncts to new buildings, such as store-windows, steps, signs, etc. While Seattle is yet a comparatively small city, it is ambitious to become a great city, and will doubtless realize its ambition in time. It is in the beginning, however, when space is less valued and obstructions are less noticeable, that these evils take root; but they increase in proportion to the general growth of the city, and by the time they are recognized as a serious nuisance their removal becomes a difficult and expensive task. It is much the easier and more sensible plan to suppress them from the start, and this Seattle now has an opportunity to do in that section of the city where obstructions do the most harm. Even with the wide streets and broad sidewalks characteristic of our newer cities, stringently administered laws affecting the sidewalk excrescences referred to in our last issue are necessary for the comfort of the public and the general appearance of main thoroughfares.

THE Binghamton, N. Y., city authorities have discovered a new method of impressing upon railway corporations the propriety of removing grade crossings. The plan adopted was to arrest the engine-drivers who blocked street crossings with trains in violation of a city ordinance, and to fine them $50 each. Very probably the men arrested could not help it, and their company had to pay the fine, but they were held as the agents of the corporation and as the only agents the city could lay its hands upon. This blocking of streets, in defiance of all local law, is so common that the average locomotive engineer seems to have forgotten that the public has any rights that he is bound to respect; consequently a sufficiently frequent application of the Binghamton medicine is likely to have a beneficial effect. A fine of $50 is 4 per cent. on $1250, and it only requires that the dose be repeated often enough to convince the railway authorities that they must either change their methods of handling trains and keep off the crossings—a thing not always possible—or they must abolish grade crossings altogether; the last is the true solution of the problem.

THE Government report on the use ofmetal sleepers for railways, by Mr. E. E. RUSSELL TRATMAN, which was noted among "Publications Received" last week, is a preliminary report only. We may state that Mr. TRATMAN is now preparing his final report, and will be glad to receive communications from engineers, railway men, or others having practical experience to record or opinions to present in connection with the subject of metal sleepers vs. preserved or unpreserved wooden sleepers, for railways and street railways, or on the general subject of timber supplies. He will also be glad of references to existing literature on the subject. Letters may be addressed to this office.

The Railway Systems of the Southwest.

The section of the United States shown on the accompanying map contains a far greater area still unprovided with railway lines than any other portion of the United States whose systems we have yet described. At the same time, as our map shows, certain sections of these States are well supplied with roads, so well supplied, in fact, that they cannot furnish traffic enough to enable them to do a profitable business. Almost all these lines, however, have been built within a very few years. Reference to the colored diagram of railway construction in ENGINEERING NEWS of April 27, 1889, shows that a score of years ago there was but a little more than 2,000 miles of railway in the States shown upon our map, including the mileage of Colorado as well.

The six States of the Southwest shown on our map are widely different in their characteristics. Kansas was settled chiefly by hard-working Yankees, whose enterprise and push have made the State far more prominent than others with better natural resources. Missouri, with a better soil and climate, has suffered from social and political causes, and is only recently improving her opportunities and developing her natural wealth in mines and forests. The same may be said of Arkansas and Louisiana, except that they are still farther behind. The fertile Indian Territory, except for the recently opened Oklahoma country in its center, is still a barrier on either side of which the current of civilization presses, while Texas, stretching 750 miles from north to south and 800 miles from east to west, contains within its limits the extremes of desert and swamp, of civilization and barbarism. The area lying between Galveston and the Red river, however, is alone larger than most of its neighbor States in area, and contains a greater network of railways than any other part of the Southwest except that in eastern Kansas and western Missouri.

As to the traffic resources of the Southwest, they are never likely to equal those of the grain-producing States in the Northwest. Cotton will doubtless continue to be the chief staple which is carried to the Northern markets; and its bulk is insignificant compared with the product of a corn and wheat growing country, which has to be carried, perhaps, 4,000 miles to find a market. The bulk of the cotton-seed is indeed considerable, but that is generally carried but a short distance to the mills. In mineral products, parts of Arkansas, Indian Territory, and Missouri may sometime furnish considerable traffic, and the recently developed lumber trade from this section gives promise of good profits for a long time to come. On the whole, however, the traffic of the railways of the Southwest must always be light in proportion to their tributary area, as compared with grain-growing, mining, or manufacturing districts elsewhere. At the same time it is true that most of the Southwest has poorer transportation facilities in proportion to its traffic than the Northwest, and it is likely to be one of the chief centers of railway construction when that work revives.

We have classified the railway systems of the Southwest in three divisions: the Gould systems, about 10,000 miles in extent, including all those lines in which Mr. JAY GOULD and those interested with him are believed to hold an important though not always a controlling interest; the other Southwestern systems, nearly 12,000 miles in extent, of which one company, the Atchison, Topeka & Santa Fé, controls over 7,000 miles; and the systems of the Northwest, which have extended their lines in Kansas and Missouri.

THE MISSOURI PACIFIC.

The 5,012 miles of railway which now constitute the Missouri Pacific system include main lines from St. Louis west to Pueblo, Col., 921 miles, and Omaha, Neb., 500 miles; also a line southwest (the St. Louis, Iron Mountain & Southern Railway) to Texarkana, 490 miles. The company leases the Central Branch of the Union Pacific Railway from that corporation until the year 1911, and last year completed an extension to Prosser, Neb., 592 miles from St. Louis. The total mileage in Nebraska is about 300 miles. The State of Kansas has the greatest mileage of any State in which the system lies; but in this State, as our map plainly shows, it meets competition at almost every point from companies as strong as itself. The Iron Mountain division of the system has now practically no competition except that of the Mississippi steamboats.

The predecessor of the Missouri Pacific Company was chartered in 1849, and about 170 miles, from St. Louis west to Sedalia, were completed by 1859. In 1865 the line was opened through to Kansas City. In 1880 several short lines in western Missouri and eastern Kansas were consolidated with the parent company, and in the same year a lease was effected of the Missouri, Kansas & Texas system. In the following year the St. Louis, Iron Mountain & Southern Railroad and the International & Great Northern Railroad in Texas were absorbed. In January, 1886, the managers of the company announced that about 690 miles of extensions completed and under construction, principally in the State of Kansas, had been added to the company's mileage; and during 1886 and 1887 the actual tracklaying on extensions of the system was 2,014 miles. In 1888 the company built about 260 miles. Near the close of 1888, bondholders of the Missouri, Kansas & Texas and the International & Great Northern appealed to the courts, and those systems were placed in the hands of receivers.

Since its organization in 1880 the company has paid to its stockholders dividends amounting to 52 per cent. on the capital stock, an average of about 6 per cent. That holders of the company's securities do not expect such returns in the future, however, is evidenced by the fact that the stock now sells in the vicinity of 70, while during the same month two years ago it varied between 106 and 112. While confidence in the company's financial standing is at so low an ebb, it is altogether unlikely that any attempt will be made to float additional securities in the market for the purpose of extending the system. Considerable work has been done on surveys for new lines in Arkansas and in southwestern Missouri, however, and the road built last year up the Arkansas Valley in Indian Territory will probably be extended soon to a junction with the Kansas lines.

THE TEXAS& PACIFIC.

The Texas & Pacific railway consists of a single main line extending from New Orleans, La., to El Paso, Tex., 1,163 miles, with a loop line from Marshall north via Texarkana, Paris, and Sherman to a junction with the main line at Fort Worth. The first construction on this system was was done in 1863, when 20 miles were built. In the next 10 years the system increased to 425 miles, and in 1882 the line was opened for through traffic from New Orleans to El Paso. In 1884 the floods in Louisiana and bad crops in Texas cut down the earnings, the company was unable to meet its interest charges, and the road was placed in a receiver's hands. The receiver was discharged Oct. 31, 1888, and the road is now operated by a company whose chief financial officers are the same as those of the Missouri Pacific, Mr. JAY GOULD being President. The company is believed to be now organized on a substantial basis, and the prospects for earnings are very good. The eastern portion of the line runs through a heavily timbered country, which is expected to supply a large lumber traffic in the future. The

western division is located in the arid belt, but secures a considerable live stock traffic from the cattle ranges. The managers of the company favor the policy of supplying their road with short feeders and branches to collect traffic and encourage local industries, and will go ahead with that work as fast as funds are available. Much remains to be done on permanent improvements, however, for nearly 300 miles of the main line is still laid with iron rails, and until this work is completed, no great amount can be afforded for extensions.

THE MISSOURI, KANSAS & TEXAS.

This system consists of a line from Dallas, Tex., north to Parsons, Kan., where it forks, one branch going northwest to Junction City, Kan.; the other northeast to Hannibal, Mo., 680 miles from Dallas. Very recently the receivers of the company have leased the Kansas City & Pacific Railway, obtaining thus a line from Parsons north to Paola and thence over the Kansas City, Fort Scott & Gulf tracks to Kansas City. In Texas the company controls a line from Denison south to a terminus 50 miles west of Houston, a distance of 347 miles. A portion of this, however, is trackage over the Texas & Pacific. Several other short branches in Texas bring the total extent of the system up to 1,681 miles.

The company was organized in 1870 by the consolidation of several other roads under construction or partly completed. By 1873 the lines from Hannibal and Junction City south to Denison, Tex., were open for traffic. In 1880 a lease was effected to the Missouri Pacific, and in 1888 default was made and the road was placed in the hands of the receivers. Plans for its reorganization are now being discussed. The system when operated by itself, is unfortunate in its terminal points at the north. Hannibal and Junction City may be as good as St. Louis and Kansas City, but undeniably they are not as great. The new outlet to Kansas City is expected to help remedy this defect and may do so to a certain extent. The line through Indian Territory has to depend on through traffic, of course, for its revenue, and four other lines are working for a share of that. The coal mines in the territory, if properly managed, ought to furnish the road considerable traffic. The Texas lines are located in that part of the State where railways are already thickest. At the time of the receivership, construction was in progress on lines in Texas from Dallas to Waco and from Bastrop to Houston. The former of these roads is being slowly completed by the receivers, but the condition of the system is such that a large sum must be spent in permanent improvements for some time to come, and not much can be spared for new construction.

THE INTERNATIONAL & GREAT NORTHERN.

This system extends from Longview to Laredo, Tex., 496 miles, with a branch from Palestine to Galveston, 200 miles. There are a few short branches. The company was organized in 1873 by a consolidation of the International Railroad and the Houston & Great Northern Railroad. In 1878 the road was placed in a receiver's hands and the company was reorganized. In 1881 the whole system was leased to the Missouri, Kansas & Texas Company, which was then part of the Missouri Pacific system. When a receiver was appointed for the former company last year, the International & Great Northern bondholders secured an administration of their property by separate receivers.

This system, like the Missouri, Kansas & Texas, is somewhat unfortunate in its northern termini. Ft. Worth and Dallas are the railway centers for northern Texas, and these it cannot reach. As a link in a through line to St. Louis by connection with the St. Louis, Iron Mountain & Southern, or St. Louis, Arkansas & Texas, it ought to secure much traffic. The road also promises to gain in importance as a through line to Mexico, since the completion of the Mexican National Railway from Laredo south has made this the shortest route. This will be still more the case when the managers of the latter road yield to the inevitable and widen their road to standard gauge.

THE ST. LOUIS, ARKANSAS & TEXAS.

This system extends from a point opposite Cairo, Ill, and from Delta, Mo., southwest through central Arkansas to Gatesville, Tex., 723 miles from Cairo. Branches reach Ft. Worth, Sherman, Hillsboro, and Lufkin, Tex., Shreveport, La., and Little Rock, Ark. The total extent of all lines is 1,257 miles.

The company was chartered as the Texas & St. Louis Railway Co., in Texas in 1879, and the road was opened from Texarkana to Trinity by the close of 1880. In 1883 the whole line from Cairo to Gatesville was opened for business. Early in the next year the road was placed in a receiver's hands where it remained for two years. It was reorganized under its present name in 1886, and the new management at once set about the work of improvement. The whole system was widened to standard gauge, and 409 miles of branch lines and extensions were built in 1887 and 1888. During 1888 the net earnings over operating expenses were less than $22,000, and in the early part of the present year the company became embarrassed for funds. A loan was obtained from a syndicate headed by JAY GOULD, under the terms of which the syndicate was given an important share in the control of the company's affairs. Default was made in the payment of interest, however, and in May a receiver was appointed.

The object of Mr. GOULD in obtaining control of this road is quite plain. It was a parallel line to, and the only important competitor of, his Iron Mountain division. Had its managers been able to carry out their plans and build an extension to St. Louis, it would have been a rival of great importance. What its future history will be, is of course conjecture; but it seems most likely to be reorganized as part of the Missouri Pacific system.

THE ATCHISON, TOPEKA & SANTA FE.

Chief among the Southwestern systems independent of the GOULD control is the Atchison, Topeka & Santa Fé. Its lines extend from Chicago west to a terminus in the extreme southwestern corner of the United States, at National City, Cal., a distance of 2,344 miles. Its most southern lines reach Guaymas, Mex., 2,000 miles from Chicago; El Paso, Tex., 1,640 miles from Chicago; and Galveston, on the Gulf of Mexico, 1,407 miles from Chicago. The most northern points reached, besides Chicago, are St. Joseph, Superior, Neb., and Denver. The system has mileage in ten States and Territories and in Mexico. With the exception of the Northern Pacific, it is the only system extending from Chicago to the Pacific coast. The total extent of the system is 7,133 miles. Of this 3,024 miles are the Atchison system proper, 3,519 miles are auxiliary roads, leased, owned, and controlled, and the remainder is mileage owned jointly with other companies, only the Atchison's half being included in the above total.

The company was incorporated in 1859, but construction did not begin until ten years later. About 450 miles of the main line were built in the next four years, but after that little was done in the way of extension for some years. In 1879 and 1880 construction on a large scale was put under way, and the transcontinental line was finished to Deming, N. M., 1,135 miles from Atchison, on Mar. 1, 1881. In that year and the following the company did a large amount of work in New Mexico and on branch lines in Kansas, obtained control of the Sonora Railroad in Mexico, and by the close of the year the lines operated had an extent of over 1,800 miles. The company also joined with the St. Louis & San Francisco in the Atlantic & Pacific enterprise and completed it in 1883. To give it an outlet to the coast, the California Southern system was acquired. In 1886 the Gulf, Colorado & Santa Fé system in Texas, with an extent of 1,000 miles, was acquired, and the company set about extension work at all points on a greater scale than ever before. In 1886, 725 miles were built; in 1887, 1,729 miles; and in 1888, 174 miles. The most important of these were the Chicago extension, the Denver extension, the line across Indian Territory, and the extensions in southern California.

Since 1879 the company has paid to its stockholders dividends amounting to 55 per cent., besides a 50 per cent stock dividend in 1882. In 1888 the results of the previous years' work began to tell; the great mileage of newly completed extensions necessarily had to begin business with a small traffic, and their earnings were in many cases not enough to pay their operating expenses. A close network of branches had been built in Kansas; and the traffic, which was none too heavy to support them, had to be divided with the competing lines of the Missouri Pacific and Rock Island systems. Poor crops in many sections were added to poorer rates on through lines by reason of the stress of competition. It became apparent that to a certain extent the company's managers had been too confident as to the immediate future, and in common with many other railway managers in the West, though to a greater extent, perhaps, than any other, had forced their lines far ahead of the traffic. The company's stock, which had sold within ⅛ per cent. of 120 in June, 1887, fell steadily downward, and has ranged lately as low as 36¾.

A railway corporation, like a person, finds plenty of friends in prosperity and very few in the days when friends are needed. While the Atchison Company was engaged in wholesale extension work, nothing but praise of the enterprise of its managers was heard. The papers were full of stories of consolidations and leases, and the system was extended to San Francisco and to New York every few weeks in the minds of imaginative reporters. Now that the tide is the other way, tales of a receivership, of the utter ruin and collapse of the whole system, and condemnation of every extension and of the country through which they are built, are as common as praise was before. One opinion is as valueless as the other. Let us see what the plain facts are in reference to the earning powers of the system.

In the first place, few will dispute now that it was a mistake to push extension work so fast and load down the company with so much new and unproductive mileage at one time. The line between Chicago and Kansas City, for instance, has to divide business with seven competitors. To the lasting honor of the Atchinson managers it should be said, however, that they have not used this line as a club to demoralize all the Northwestern systems. Now that this and other lines are built, we must make the best of it. An examination of our map of the Northwestern systems will show that the Chicago line runs through an excellent country and does not closely parallel any existing line for most of the distance. In

the long run it will be a good investment for the parent company. The Gulf, Colorado & Santa Fé system in Texas was able to earn nearly $1,600 per mile over operating expenses in 1883. It has now more competition than then, but this should be offset by the growth of its tributary territory and the advantage of a direct connection north through Indian Territory. This latter line should do pretty well on its local traffic alone, from now on, as it is the only railway through Oklahoma. The company's lines in southern California are still too new to show good returns. They were built for a local traffic which by all reports ought soon to be great enough to make them profitable properties. As for the transcontinental traffic, the company has paid pretty roundly for its share; but the growth of Pacific coast business has been such of late that future prospects of profit are certainly good. The most unfortunately located portion of the Atchison lines are some of the numerous branches in the State of Kansas. Doubtless the construction of each one of these was believed to be a move of good policy, but the good policy is not apparent from an inspection of our map. The plain fact is that the enterprising Kansans, in their desire to boom their State, have over-reached both themselves and the railway companies. They have caused the building of twice as many railways as they can furnish traffic enough to decently support; and because the companies are obliged to charge rates high enough to pay their operating expenses, the people are anxious for still more railways and for legislative control of rates. It should be said, however, that Kansas is the only State in which the Santa Fé system is located where legislative control of rates may be expected for some time to come, and in this respect the company is more fortunate than those operating in the States of the Northwest.

The proposed extensions of the system are very numerous, but our space will not permit a discussion of them here. They are none of them likely to be undertaken for a long time to come.

THE ST. LOUIS & SAN FRANCISCO.

The line controlled by this company extends from St. Louis southwest to Monett, Mo., where it separates, one branch running a little west of south to Paris, Tex., 584 miles from St. Louis, the second southwest to Sapulpa, Ind. Ter., 438 miles from St. Louis, and the third west and north to Ellsworth, Kan., 608 miles from St. Louis. A dozen branches bring up the total extent to 1,855 miles. The present St. Louis & San Francisco Company is the successor to several companies, the earliest of which was the Pacific Railroad Company of Missouri, chartered in 1852. The line from Pacific, Mo., to Rolla, 81 miles, was just finished at the beginning of the war. Nothing further was done until 1869, when, under the name of the South Pacific Railroad, the road was pushed on to Pierce City, 287 miles from St. Louis. In 1876, after passing through bankruptcy, the road came into the hands of the present company. During the past three years the company has added 364 miles to its system. The company is equally interested with the Atchison Topeka & Santa Fé, in the Atlantic & Pacific Railway, and also in the Wichita & Western road in Kansas. By the terms of a contract made at the time the interest in the Atlantic & Pacific was acquired by the Atchison, the two systems are operated in harmony and do not infringe on each other's territory. With the Missouri Pacific the company is on friendly terms, and Mr. GEORGE GOULD is one of the company's directors.

The company's stock is of three classes, first preferred, preferred, and common. The first preferred stockholders have received 7 per cent. dividends since 1881. The preferred stockholders received their first dividend in 1887.

The lines of the company are generally well located to secure a fair traffic. The managers of the company desire to extend the Atlantic & Pacific Railway across the Indian Territory and the Texas Panhandle to Albuquerque, N. M., thus making their line the direct transcontinental route instead of the Atchison, Topeka & Santa Fé as now. It is pretty certain that this will be done at an early date. The company also desires to make some extensions in Arkansas, and will probably secure an entrance to Kansas City from the south whenever a favorable opportunity offers.

The general trend of the systems thus far described is from northeast to southwest. This system and the following cross at right angles to the main lines of other systems, and trend from northwest to southeast. The main line of this system, from Kansas City to Birmingham, Ala., is 738 miles in length. A loop line and branch in Missouri, three branches in southeastern Kansas, and a few short lines, bring up the total extent of the system to 1,189 miles. The original line of this system was completed from Kansas City to Baxter Springs, Kan., in 1870. The company became bankrupt in the panic of 1873 and was reorganized in 1879. Since then the various branches and extensions have been built, generally, by nominally independent companies. Last year a consolidation was effected of part of the companies whose lines form the system; but the line from Memphis to Birmingham, the Current River Railroad, and some others, are still nominally independent. The THAYER-MERRIAM syndicate, of Boston, are the chief owners of the system.

For most of its length the main line has no competition, so far as local traffic is concerned. Lumber forms an important part of the freight, especially in southern Missouri. The only extension definitely planned is from Aberdeen to Columbus, Miss., but there has been some talk of an extension to a terminus on the Atlantic coast, a scheme not likely to be soon carried out.

THE PANHANDLE ROUTE.

This is the name at present applied to a system whose lines are at present owned by three companies, the Denver, Texas & Fort Worth, Denver, Texas & Gulf, and the Fort Worth & Denver City. The roads owned by these companies form a through line, extending from Denver, Col., to Fort Worth, Tex., 803 miles. Branches bring up the total extent to 853 miles. The proposition to build a railway from Denver to the cities of northern Texas, and eventually to New Orleans, was agitated at both the proposed termini early in the 70's; but construction did not begin till 1882, when about 100 miles was built on the Texas end, and about 50 miles from Denver south. Construction dragged from that time till 1886, during which time one of the companies interested—the Denver & New Orleans—was sold under foreclosure, and reorganized as the Denver, Texas & Gulf. In 1886 and 1887 the work was pushed rapidly, and in March, 1888, the whole line was completed.

The building of so long a line, through what was not very long ago supposed to be a worthless desert, would once have been deemed a hazardous undertaking, but the company seems thus far to have been able to hold its own; and if it can do so at the start, its future is assured.

The country traversed is, for most of the distance from Fort Worth to Colorado, a great cattle range, and whether it will ever support any more profitable agriculture is an open question.

As seen by our map, the line is subject to no competition on local traffic; and on through traffic, between Texas and Colorado points, it is so much the shortest line as to have a virtual monopoly. Where its competition has been most felt is on through traffic between the Eastern seaports and Colorado points. In regard to this, it bears much the same relation to Denver and Colorado shippers that the Sault Ste. Marie route bears toward St. Paul and Minneapolis and their tributary territory. Instead of shipping goods over the trunk lines and Chicago systems to Colorado, they can be sent by steamer to New Orleans or Galveston and thence by rail to Denver. The disadvantages of the route are much greater than those of the Sault route, but it is able, nevertheless, to secure considerable traffic from the direct lines.

It is intended, as soon as financial conditions permit, to extend the line from Fort Worth to New Orleans, and to build some short branches.

THE HOUSTON & TEXAS CENTRAL.

This system, 790 miles in extent, consists of a main line from Houston north to Denison, on the Red river, 345 miles, with branches on the west to Austin, Albany, and Fort Worth, and on the east to Roberts. In the above are included the lines owned by the Texas Central Railway Company, 229 miles in extent, being the line from Ross to Albany, and the branch to Robert; also the lines of the Central Texas & Northwestern Railroad and Fort Worth & New Orleans Railroad, these linse being operated by the Houston & Texas Central Company.

The main line of the Houston & Texas Central was completed in 1873. In 1885 the lines of the system were placed in a receiver's hands, where they still remain. The Southern Pacific Railway Company is largely interested in the system, and when reorganized it will be brought under that company's control. The system as a whole is subjected to sharp competition, the part of the State through which it runs being pretty well supplied with railroads.

NORTHWESTERN SYSTEMS IN KANSAS AND MISSOURI.

The Union Pacific Company now operates 1,318 miles in the State of Kansas. The main line from Kansas City to Denver was built as the Kansas Pacific, and was completed in 1870. Default was made in interest payments in 1873, and the company was not reorganized till 1879. It was consolidated with the Union Pacific in 1880. Within the past two years the company has completed a second main line from Salina nearly to the western boundary of the State. The Central Branch from Atchison west to Lenora, nearly 300 miles, with branches 384 miles, was leased to the Missouri Pacific Company in 1885 for 25 years. The company's lines in Kansas are for the most part not closely paralleled by other roads and are doing a fair business.

The entrance of the Chicago, Rock Island & Pacific systems to Kansas is quite recent. Construction was begun in 1886, and in that and the two following years the company built 1,373 miles west of the Missouri river. The lines extend from St. Joseph, Mo., west to Colorado Springs, Col., a distance of 609 miles, and 1,109 miles from Chicago. Another line runs south via Topeka to Herington, where it branches, one short line running to Salina and the others terminating at Liberal, on the southwestern border of the State and at Pond Creek, Ind. Ter.

The company's managers claim that the construction of this system of extensions west

of the Missouri was a necessary move to secure for the Rock Island lines east of the Missouri a fair proportion of the through traffic. The time may yet come when their judgment in the case will be amply vindicated. From all we can learn the new extensions which the company has built are thoroughly well constructed and are securing their full share of the traffic. Rock Island stockholders, who grumble at reduced dividends, should remember that there are other causes than over-construction for reduced earnings, and that sometimes it is not possible to stand still and be safe

According to our best information, the company has by no means finished the work of extension. The line now terminating at Pond Creek, Ind. Ter., is to be pushed on south into and perhaps through Oklahoma this season. The proposed extensions in southwestern Kansas, Texas, and New Mexico, for which surveys have been made, are pretty sure to be postponed for a good while.

The Chicago & Alton and the Wabash systems were described in connection with our map of the Northwestern systems in ENGINEERING NEWS of June 1, 1889. They are only important as regards traffic from Kansas City to St. Louis and Chicago and the local traffic of northern Missouri. The Wabash system bids fair to become a much more important factor in Western railway matters, now that it has been reorganized and set on its feet again.

Besides the systems above described, in southern Louisiana and Texas beyond the limits of our map, the Southern Pacific Company controls railway lines with an extent of 1,687 miles, and the San Antonio & Aransas Pass Company operates a system 466 miles in extent. Including this mileage, the mileage of the Queen & Crescent system in Louisiana, and the mileage of the Northwestern systems within the States of Kansas and Missouri, and subtracting that mileage of the Southwestern systems proper which is beyond the limits of the Southwestern States, we have the total mileage of railways in these States included in systems as 24,845 miles. The total mileage of these States—Missouri, Kansas, Arkansas, Indian Territory, Louisiana, and Texas—is 27,439 miles, leaving 2,594 miles, or not quite 9½ per cent., as the mileage of independent lines. This is a greater percentage of lines in systems than we have found in any other section, though it varies but little from the Northwestern States, where 10.4 per cent. of the mileage consists of independent lines.

PERSONAL.

President SCOTT, of the Colorado Midland Ry., has resigned.

Col. L. C. JONES, C. E., Superintendent of the Carolina Central Ry., died at Wilmington, N. C., July 12.

Mr. CHARLES W. OGLE, contractor of the Findlay Water-Works, was drowned in the Johnstown flood.

Mr. S. T. WELLMAN has been appointed Consulting Engineer for the Illinois Steel Co. at Chicago, Ill.

Mr. STEVENSON TOWLE, M. Am. Soc. C. E., has resigned his position as one of the Park Commissioners of New York City.

Mr. E. C. MURPHY has been appointed Superintendent of the Chicago & Atlantic R. R., vice F. W. BARROWS.

Mr. F. W. D. HOLBROOK has been appointed Manager of the Seattle, Lake Shore & Eastern Ry., vice Mr. W. R. THORNELL resigned.

Mr. W. C. IRWIN has been appointed Chief Engineer of Maintenance of Way of the Cleveland, Cincinnati, Chicago & St. Louis Ry.

Mr. H. H. MANSFIELD, dealer in railroad and contractors' supplies, has removed from 36 Pine St. to 52 Wall St., New York City.

Gen. THOMAS EWING has been elected President of the Danville & East Tennesse road, a new line projected to run from Danville, Va., to the Tennessee line.

Mr. T. C. COMSTOCK has been appointed Assistant Superintendent of the Fargo & Southwestern division of the Northern Pacific, vice L. GREER, resigned.

Mr. THEODORE D. KLINE has been appointed General Superintendent of the entire Mexican National system; and Mr. J. N. GALBRAITH, Division Superintendent.

Mr. J. H. BERRY has been appointed Master Mechanic of the Chicago & Atlantic R. R., vice Mr. W. H. SELBY. His office will be at Huntington, Ind.

Mr. PULASKI LEEDS, Division Master Mechanic of the Louisville & Nashville road for some years, has been appointed Superintendent of Machinery on the road.

Hon. EDMUND RICE died at White Bear, Minn., July 11. In 1856 he was elected President of the Minnesota & Pacific Ry. Co., and later he was also President of the St. Paul & Pacific Ry. and the St. Paul & Chicago Ry.

Mr. C. O. PARKER has been appointed Assistant General Manager of the Jacksonville, Tampa & Key West Ry., with headquarters at Jacksonville, Fla. He was formerly Chief Engineer of the Georgia Central Ry., at Macon, Ga.

Col. CHAS. H. LOCHER, at one time a prominent contractor, died at Balcony Falls, Rockbridge Co., Va., on July 14, aged 70 years. He founded the famous James River Cement Works many years ago, and was one of the chief contractors for building the James River and Kanawha canal.

Sir GUILFORD L. MOLESWORTH, M. I. C. E., the eminent engineer, and the author of "Molesworth's Engineering Pocket-Book," was in New York this week, on his way from India to England. He recently resigned the position of Consulting Engineer for State Railways to the Government of India, which he has held for several years.

Mr. C. S. DWIGHT has been appointed Superintendent and Chief Engineer of the New Orleans, Fort Jackson & Grand Isle Railway of Louisiana, now under construction from Algiers to Ft. Jackson, 65 miles. His office is at 36 Carondelet St., New Orleans.

Mr. S. TOMLINSON, Dept. Ex. Engineer of Water-Works, Bombay, India, writes Mr. EDWIN DARLING, Superintendent of the Pawtucket (R. I.) Water-Works, that he will arrive in New York about Aug. 8, on a tour of inspection of leading water-works of the United States prior to sailing for Australia on Aug. 24. His department contemplates the expenditure of $750,000 for reservoir and filtering appliances and before closing any contracts he desires to know what is being done in this line in this country.

Lieut. O. M. CARTER, U. S. Eng., who was accused of certain misconduct in connection with contractors Greene & Gaynor, in Government work on the Savannah river, has been fully exonerated in a lengthy report by Col. R. P. HUGHES, Inspector General. The accusing party was Mr. W. R. CURTIS, a civil engineer in Government employment, and the report explains that the animus of the attack on Lieut. CARTER and the two contractors named lay in the fact that his work was not satisfactory to Lieut. CARTER, and that "the use of stimulants had so deranged his (CURTIS') nervous system that his memory is no longer thoroughly reliable."

Loss of Head due to the Friction of Water in New Cast-Iron Pipes.

The appendix to the last annual report of Mr. SAMUEL M. GRAY, City Engineer of Providence, R. I., contains an exceedingly useful table under the above head. The pipes noted are 4 ins., 6 ins., 8 ins., 10 ins., 12 ins., 16 ins., 20 ins., 24 ins., 30 ins., 36 ins., and 48 ins. in diameter. The first column of the table gives the mean velocity in feet per second of the water flowing in the pipes. The second column gives the head required to produce this velocity, calculated by the law of falling bodies, independent of friction, loss of head due to influx, and other retarding causes. The third column gives the discharge in U. S. gallons per minute, and the fifth column the discharge in U. S. gallons per 24 hours, when the water is flowing with the velocity given in the first column.

The fourth column gives the loss of head, or resistance, per 1,000 ft., arising from the friction of the water against the sides of the pipe, with velocity and discharge as given in the first and fifth columns. This loss of head is also equivalent to the inclination in the pipe necessary to maintain the given velocity and discharge. The results in this column are computed from two formulæ of H. DARCY, reduced to English measure as follows:

$$h = \left(0.017370 + \frac{0.0015605}{d} + \frac{0.0040723}{v} + \frac{0.000020816}{d^2}\right)\frac{l}{d}\,\frac{v^2}{2g}$$

$$h = \left(0.0198020 + \frac{0.0016573}{d}\right)\frac{l}{d}\,\frac{v^2}{2g}$$

in which

h = loss of head due to friction, in feet.
d = the internal diameter of pipe, in feet.
v = velocity per second, in feet.
l = length of pipe, in feet.
$2g = 64.324$.

The first formula was used for velocity of flow less than 0.33 ft. per second, and the second, or that generally known as "Darcy's formula," for velocities including and exceeding 0.33 ft. per second.

The sixth column gives the loss of head due to the entrance of water into the pipe, with the edge of inlet pipe square and flush with the face of a wall or partition. The following was the formula used:—

$$\text{Loss of head due to influx} = 0.505\,\frac{v^2}{2g}.$$

These tables, occupying, as they do, 66 pages of a large octavo volume, are, of course, too bulky for reproduction in the pages of a journal. But it is to be hoped that they will be put into handy shape for use when the usually limited edition of a city report is exhausted. They were computed and arranged under the direction of Mr. EDMUND B. WESTON, Asst. Engineer in charge of the Water Department, and they represent an amount of patience and work that can only be appreciated by those who have had to do with similar tables, and will, doubtless, as they well should, gain for their author the hearty thanks of every hydraulic engineer.

CORRESPONDENCE.

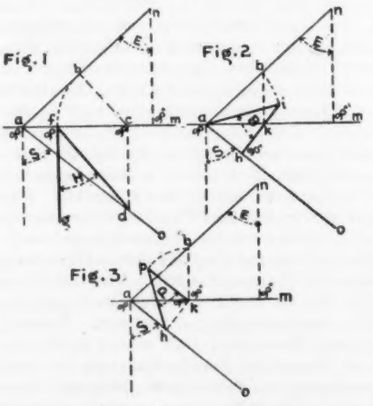
Constructing the Bevel Angles for Skew Portals.

PITTSBURG, May 27, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

The bevel angles required in laying out skew portals can be constructed in the following way:

The angles S, E, H, B and P in the figures here given have the same meaning as in the article of Mr. M. J. PATTERSON in your issue of April 27. After having drawn the angles S and E, as shown, draw in Fig. 1 from any point b of the line $a\,n$ the line $b\,c$, perpendicular to $a\,n$, make $c\,f = b\,c$; draw from f and c the lines $f\,g$ and $c\,d$ perpendicular to $a\,c$, and connect the points f and d; then we have angle $d\,f\,g = H$.



In Fig 2 draw from any point b of the line $a\,n$, the line $b\,k$ perpendicular to $a\,m$; draw from the intersection point k, of $b\,k$ and $a\,m$, the line $k\,h$, perpendicular to $a\,o$; produce $h\,k$ to the point i, make $a\,i = a\,b$ and connect a and i; then we have the angle $a\,i\,h = B$.

In Fig. 3 draw the lines $b\,k$ and $k\,h$ same as in Fig 2; draw in k the line $k\,p$ perpendicular to $h\,k$; make $k\,p = k\,b$ and connect p and h; then we have the angle $h\,p\,k = P$.

The value of the angles H, B and P as given by these figures are:

In Fig. 1: $tang.\,H = \frac{e\,f}{d\,e} = b\,c \times \frac{tan.\,S}{a\,c} = \frac{a\,b}{tan.\,E} \times tan.\,S.$

$$\frac{sin.\,E}{d\,b} = cos.\,E \times tan.\,S.$$

In Fig. 2: $Sin\,B = \frac{a\,h}{a\,i} = ak \times sin.S \times \frac{sin\,E}{a\,k} = sin\,E \times sin\,S.$

In Fig. 3: $\tan B = \frac{h\,k}{p\,k} = a\,k \times \cos S \times \frac{\tan E}{a\,k} = \cos. S \times \tan. E.$

The values given by these formulas are same as given by Mr. M. J. PATTERSON.

The three figures are shown above separately to make the construction clearer; in practice they can be combined in one figure.

CHAS. F. MULLER.

The Hundred Foot vs. The Gunter's Chain.

CHATTANOOGA, TENN., July 11, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

Can you tell me when the use of a hundred-foot chain in laying out railway curves began? What is used by English, German, and French engineers for railway line measurements? By answering through the NEWS, you will confer a favor upon Yours truly,

BENJ. THOMPSON.

[Col. STEPHEN H. LONG, U. S. Top. Engs., in 1829 published his *Railroad Manual*, the first American work on railway alignment, and in it he arranged his tables of curves, etc., for chords of 100 ft. We do not know that Col. LONG was the originator of the 100-ft. chain, but we have the authority of that veteran engineer Col. JULIUS W. ADAMS for saying that in 1831 the 100-ft. chain was used in laying out the Paterson & Hudson River Ry. It was not then a novelty, though the engineers working on the adjoining Newark & New York Ry. still adhered to the 66-ft. Gunter's chain. The relative merits of the two lengths of chain were still being discussed, however, as late as 1850, and it was still being used, we understand, as late as that date, by a few of the older and less progressive engineers. English engineers still adhere to the old 66-ft. chain in railway practice, and to the acres, roods, rods, etc., in all land measurement, instead of acres and decimals of an acre as is the usual American practice in railway right-of-way computations. Canadian railway practice, however, is practically the same as our own. French and German engineers, and in fact all continental engineers, now use the metric system for railway and other public work. The metric railway chain, as adopted by American engineers on the Mexican railways, was 20 metres long (65.61 ft.), divided into 100 links of 2 decimetres (.656 ft.) each, though a 25-metre chain is said to have been also used. We cannot now give the exact length of the metric chain in common use in continental railway practice, or whether it differs at all from the Mexican metric chain. The Gunter's chain is older than many engineers suppose, as its inventor, EDMUND GUNTER, was born in 1581 and died in London in 1626. He invented the chain, the logarithmic line, the quadrant and scale which bear his name.—ED. ENG. NEWS.]

Great Disasters.

BOSTON, July 11, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

The account of "Great Disasters," in your issue of the 6th inst., states that there are but *three* worse railroad accidents on record than the recent Armagh disasters. Should not the *four* which are mentioned be supplemented with another—the Tay Bridge failure? Will you please inform me how many were supposed to be lost by this accident? K.

[The Tay Bridge failure on Dec. 27, 1879, caused the death of 70 persons, "as near as could be ascertained." Consequently the Armagh accident, with its 75 lives lost, was still more disastrous in its consequences. Still, as the death record at the Tay Bridge so closely approached others quoted, it should also have been noted in our list. The Tay Bridge fortunately fell on Sunday night, when travel was at a minimum. Every one on the train perished.—ED. ENG. NEWS.]

Carbonized Cement Pipe.

BANGOR, Me., July 1, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

Noticing an inquiry in the issue of your paper dated June 29, relating to the durability of cement pipe "that has been carbonized in tight kilns from six to twelve days," I take this opportunity to suggest that all of the questions your correspondent raises in the above named inquiry are probably the result of a misapprehension on his part as to one of the most important features of a very valuable process of treatment to cement mortar known as "carbonization."

I am familiar with several manufactories using the "carbonized" process, and as I know of but one method of treating the cement in manufacture, will briefly describe the process in order to correct what seems to me to be a mistake on the part of the writer who asked for information.

While the cement mortar is in the molds it is conveyed to the indurating chamber, an air-tight compartment, when the molds are removed; when this chamber is sufficiently filled, carbonic acid gas is admitted. This gas is generated by burning charcoal in a common coal stove, and is conveyed into the chambers by means of a tight funnel which passes through and is entirely surrounded by a body of cold water contained in a metal or other tank; by this means the gas enters the chamber cold and not *hot*, thus preventing the mortar from being injured by heat. The cement has so great an affinity for carbonic acid gas that it rapidly takes up the gas, thus creating the draft necessary to keep the charcoal burning for six days or more. During the process the chamber is opened once or more each day, and the material being carbonized is thoroughly sprinkled with cold water by means of hose or other sprinklers.

I have witnessed the process and experimented with it, and have always found the kilns or chambers decidedly cool and moist, and the pipe, floor tile, etc., manufactured under this process, in the city of Bangor, is of a high quality. As to durability, I can only say that from inquiries in places where it has been used for nearly 20 years, the best results are reported, and pipe laid under my observation during the last 4 years, for public sewers, has been found hard enough to injure and often break the steel chisels used in breaking into it for the purpose of making drain connections, thus showing conclusively that the process of induration, "both present and future," is not arrested, but *actually promoted* by first carbonizing the mortar. The pipe I have seen also shows as much white efflorescence—usually some little time after it comes from the kilns—as any mortar used in our stone foundations or brick sewers; and the walk or floor tile, while it stands wear better than brick, shows this white efflorescence sufficiently to mar its otherwise uniform appearance. No doubt others among your readers can give information from a longer experience relating to the process, as it is well established, and has been carefully watched and tested since the process first came into use.

Very truly yours,

P. H. COOMBS, *City Engineer.*

PUBLICATIONS RECEIVED.

—*Report on Proposed Sewerage of St. Johns, Newfoundland*, by RUDOLPH HERING, C. E., accompanied by report on same by CHARLES J. HARVEY, Town Engineer, 1889.

The plan provides for the drainage of a population of 60,000 in a city of steep incline, bringing the sewage to the bay at a point where a strong tidal current will dispose of it. The "separate system," modeled on the principles laid down by ROBERT RAWLINSON, is recommended.

—*Improvement of the Mississippi River.* A Letter of CHARLES P. HUNTINGTON to Hon. REDFIELD PROCTOR, Secretary of War, U. S. A., with maps and profiles, 11 pp.

—*A Report on Certain Wing-Dams on the Rio Grande.* Message of the President of the United States, March 2, 1889. Executive Document No. 144.

This is a report, with maps, concerning certain wing-dams built on the Mexican shore of the Rio Grande, to protect it from erosion, and complained of as damaging the American side of the river at Paso del Norte. Maj. OSWALD H. ERNST, U. S. Engrs., was detailed to examine into the affair in connection with a Mexican engineer appointed for that purpose. Certain dams were declared illegal and work has been stopped upon them.

—*Proceedings of the Association of Provincial Land Surveyors of Ontario*, at the annual meeting held at Toronto in February, 1889. 130 pp. Published by the Association at Toronto, Ont.

In addition to the Proceedings, Reports of Committees, etc., the volume contains the following papers: "Original Land Marks," MAURICE GAVILLER; "Cadastral Surveys in the Province of Quebec," J. P. B. CASGRAIN; "City Surveying," T. B. SPEIGHT; "Descriptions," O. J. KLOTZ; "Right of Way Surveys," H. J. BROWNE, JOHN DAIRS and H. D. ELLIS; "Timber Exploring," W. R. AYLSWORTH; "Awards Under Ditches and Water Courses, Ont., 1883," LEWIS BOLTON; "Brantford Water-Works," T. H. JONES; "Wooden and Composite Bridges," H. K. WICKSTEED; "An Ephemeris of Stars in the Vertical of 'Polaris,'" F. L. BLAKE; "The Transit," JOHN MCAREE; "Decimal vs. Duodecimal Measurements," VILLIERS SANKEY.

SOCIETY PROCEEDINGS.

New England Roadmasters' Association.—The seventh annual meeting will be held at the American House, Boston, Mass., Aug. 22 and 23. After the regular annual business, reading of communications, election of officers, reports of committees, etc., the following questions will be discussed:

Repairs of Track:

1. Method of renewal of rails, frogs and switches.
2. Best method of renewal of ties and tamping the same.
3. Ballasting and surfacing.
4. Maintenance and alignment of tracks on tangents and curves.

Cattle Guards: Best form and material to use, with estimate of cost.

Fencing: Best material and form of fence and cost of same.

Monthly or Weekly Forms: Necessary monthly or weekly forms for the rendering of material used and classification of labor performed. Are the uses of same understood? and give the results desired.

Review of Previous Year's Questions: Road tools, nut locks, foot guards, etc.

There have been committees appointed on each question, who will report on same as each question is opened for discussion. W. F. ELLIS, *Secretary*, Woonsocket, R. I.

RAILWAYS.

EAST OF CHICAGO—Existing Roads.

Baltimore & Eastern Shore.—Work has commenced on this road, which is to run from Eastern Bay to Salisbury, Md., a distance of 54 miles. Godeffroy & Howe, of Easton, Md., are the contractors.

Columbus, Lima & Milwaukee.—Construction has been commenced at Lima, O., on this road, which is to run from Columbus, O., to Saugatuck, Mich., a distance of about 260 miles. It is stated that work will commence at Columbus as soon as the necessary profiles are completed. B. C. FAUROT, of Lima, is President.

McKeesport & Belle Vernon.—This road has been opened for traffic from McKeesport, Pennsylvania, to a point on the river opposite Monongahela City. The work of completing the road to Belle Vernon is being rapidly pushed forward. The total length of the road from McKeesport to Belle Vernon is 26 miles; eight miles of this distance, from McKeesport to Elizabeth, was built last year.

Delaware & Hudson Canal Co.—It is stated that work has commenced on the extension of the Charlotte Valley road east to a connection with the Ulster & Delaware R. R.

New York, Ontario & Western.—This company is reported to have purchased a long stretch of dock property at Cornwall, N. Y., where it will establish a large coal depot.

Kingston & Pembroke.—Work on the extension of the Napanee, Tamworth & Quebec R. R. from Tamworth to Tweed, Ont., is progressing rapidly. The grading has been completed as far as Maribank, and tracklaying is now in progress between Tamworth and Erinsville. Work is being pushed on the grading between Maribank and Tweed and it is expected to have the entire line in operation by December. It is stated that an application will be made to the Dominion Parliament for permission to build a railway from Harrowsmith, Ont., to Sydenham.

Chautauqua Lake.—A press dispatch quotes FRANCIS C. BREWER, of Westfield, N. Y., a large stockholder of the Lake Shore & Michigan Southern R. R., as saying that the surveys had been made for an extension of the Chautauqua Lake R. R. from Mayville to Westfield, a distance of 10 miles. At Westfield the road would connect with the L. S. & M. S. R. R., which company will lease the completed line. It is stated that work will begin soon.

Cincinnati, Jackson & Mackinaw.—Engineers are now at work locating the line from Addison to Jackson, Mich., a distance of about 18 miles. It is expected that construction will begin immediately.

Canada & St. Louis.—Judge VAN VLEET, of the Indiana Circuit Court, has ordered the sale of this road to take place Aug. 17. The sale will affect only 27 miles of the road and must net not less than $9,000 per mile. The road was projected to run from Bay City, Mich., via Battle Creek, Mich., Goshen, Ind., and Danville, Ill., to St. Louis, Mo. It was completed from Goshen to Battle Creek, 68 miles, and from Bay City to Midland, 18 miles, last year. The surveys have been completed from Midland to Battle Creek, 92 miles. On the failure of J. J. Burns & Co., who had the contract for building the road, it was placed in the hands of receivers. It is thought that either the Lake Shore & Michigan Southern or the Cincinnati, Wabash & Michigan railways will purchase the line.

Boston & Maine.—A bill has been introduced into the New Hampshire Legislature authorizing the consolidation of the Concord and the Boston, Concord & Montreal railways into one corporate organization. The capital stock of the new company is to be $4,800,000, of which the Concord stockholders will hold $3,000,000 and the stockholders of the Boston, Concord & Montreal the remainder. The bill also authorizes the Bos-

ton & Maine railway to purchase the Eastern (Mass.); the Eastern (N. H.); the Portsmouth, Great Falls & Conway; the Portland, Saco & Portsmouth; the Wolfboro, Portsmouth & Dover; the Worcester, Nashua & Rochester railways, which it now leases, and to lease the Northern (N. H.) and the Boston & Lowell railways. Provisions are made for compensating the dissenting stockholders and increasing the capital stock. It is thought that on the passage of the bill the Concord R. R. will be absorbed by the Boston & Maine system. It is reported that the building of a branch to West Springfield, Mass., to connect with the Springfield branch of the Hartford & Connecticut Western R. R. is under consideration.

New York, Ontario & Western.—The legal battle between this company and the New York, Lake Erie & Western R. R. Co., over the right of way of the Ontario, Carbondale & Scranton branch to the Lackawanna coal-fields has been decided in favor of the N. Y., O. & W. The line, which runs from Scranton, Pa., to Hancock, N. Y., 40 miles, will be pushed rapidly to completion.

New York, New Haven & Hartford.—Chief Engineer F. S. CURTIS is now at work on plans for the double track between South Lyme and East Lyme, Conn. The work is to be finished by Aug. 15. A short spur line will be built from the main line to Niantic, the camp-ground of the State National Guard.

Cincinnati, Hamilton & Dayton.—Reports are in circulation to the effect that negotiations have been concluded by which this road has been leased to the Louisville & Nashville R. R. Co. The terms of the lease are that the L. & N. is to pay all fixed charges on the floating debt of nearly $2,000,000 and guarantee a dividend of 3 per cent. on the stock. As the road paid over 14 per cent. on the capital stock as a result of operations in 1888, and every effort is being made to pay off the floating debt incurred by the company under the IVES management, it is not probable that a lease has been entered into under such terms.

Rochester, Hornellsville & Lackawanna.—At a recent meeting of the stockholders this company was consolidated with the proposed Lackawanna & Pittsburg R. R. running from Wayland to Geneva, N. Y., 40 miles. The two lines when completed will run from Hornellsville to Geneva, 61 miles. This is thought to be the first step toward a through line from Rochester, N. Y., to Coudersport, Pa., and south. The Rochester & Honeyoe Valley will be extended to Perkinsville, where it will connect with the line to run from Geneva to Hornellsville and from this place the Coudersport, Hornellsville & Lackawanna R. R. will complete the line to Coudersport, Pa.

St. Joseph Valley.—Mr. J. J. BURNS has made an offer to build the extension of this road from Buchanan to South Bend, a distance of 30 miles, for $10,000. The road is now in operation from Buchanan, Mich., to Berrien Springs, 10 miles.

Hartford & Connecticut Western.—At a meeting of the stockholders, recently held, it was voted to proceed at once with the construction of the branch from Tarriffville, Conn., to Springfield, Mass. The line will pass through the towns of Simsbury, East Granby, Sheffield, Agawam and West Springfield. The length of the road will be 18 miles.

Central New England & Western.—It is reported that the syndicate in control of the Poughkeepsie Bridge and the Connecticut Western R. R. is endeavoring to secure control of the Connecticut River R. R. by purchasing a majority of the stock. The company would thus secure valuable terminal facilities at Springfield Mass.

Lancaster & Hamden.—In reply to the statements made by Mr. JESSE A. PRITCHARD, of Darbyville, O., concerning this enterprise in our issue of July 6, E. P. BUELL, formerly Chief Engineer of the company and now of the firm of Buell & Co., the contractors for the construction of the road, writes us giving the following references as to the character and standing of his enterprise: Gen. JOHN G. REEVES, President; PHILIP REISEND, Treasurer, and B. F. DEEMS, Secretary, of the Lancaster & Hamden Ry. Co., all residents of Lancaster. Mr. REEVES is President of the Fairfield County Bank and Mr. DEEM is County Auditor. Also to Messrs. JAS. BALLARD and W. H. MOWRY, Directors of the company at Tarlton, O.; Col. HAWK, President, and OTIS BALLARD, Cashier of First National Bank of Circleville, O.; Hon. J. C. HAUFER, Treasurer-elect of Pickaway County, O.; and Judges COURTRIGHT and ROOSE, of Circleville.

We have also received a letter dated at Tarlton, O., July 9, and signed by SAM. EFFINGER, Assistant Chief, and FRANK H. ALFRED, Assistant Engineer, of the Lancaster & Hamden Ry. with the following statement: "We have been in the employ of said company since its organization, in the Engineering Department, and can say that the statements made by J. A. PRITCHARD in your issue of July 6 as to quantities and grades on the road are far from being true." The statement is also made in both these letters that Mr. PRITCHARD was in the employ of the company about two months and was discharged about Jan. 1, 1889. We admit this statement to our columns only because of its possible bearing on the statements made in our issue of July 6. We must remind our correspondents that we have no room in our columns for matters of a personal nature in this or other similar controversies. It is statements regarding the progress, financial standing, and prospects of the enterprise itself, which we desire; for in the long run its inherent merits are what determine its success, and not the personal character of its promoters.

Cincinnati, Washington & Baltimore.—Announcement has been made that arrangements have been completed for carrying out the plan of reorganization of this company. The railway property is to be purchased at foreclosure by the trustees, who will organize a new company. The new company will issue $35,600,000 of bonds and $5,000,000 of stock, interest not cumulative. The road will be sold in August.

Projects and Surveys.

Northern Maine.—Chief Engineer FREDERIC DANFORTH, of Houlton, Me., has just finished a detailed examination of the region through which this road is to run. He reports that the entire length of the line from Presque Isle to Mattawamkeag will be less than 116 miles; there will be no bridge over 100 ft. in length, and no grade exceeding 65 ft. to the mile. About $90,000 of the $100,000 asked by the company has been subscribed. Hon. GEO. R. WESCOTT, of Portland, Me., is President.

Nova Scotia & Cape Breton.—An act has been applied for, incorporating a company to build a line of railway to run from Orangedale, via Broad Cove mines and Margaree to Chetacamp, Cape Breton, a distance of 75 miles. Also a branch to run from Richmond mines to Louisburg, a distance of 78 miles.

Harrisburg & Grantsville.—A project is on foot to build a railway from Harrisburg, Pa., to Grantsville, Md., a distance of about 125 miles. The object of the road is to open up the timber and mineral lands along the route.

Sandusky, Columbus, Lake Erie & Southern.—CHAS. A. JUDSON, of Sandusky, O., Chief Engineer, has completed a survey for this road from Sandusky via Attica, Bucyrus, Bellevue and Delaware to Columbus, 110 miles. It is stated that another line will be run via Galion, Mt. Gilead and Bellevue.

Rolf & Northern.—Incorporated in Pennsylvania to build a line of railway from Rolf, Elk county, to Broad Level, in the same county, a distance of 20 miles. Among the incorporators are J. BAYARD HENRY, Jos. D. POTTS, STEPHEN GREEN and EDW. J. ALEDO; all of Philadelphia.

Troy & Averill Park.—At a meeting of citizens recently held at Troy, N. Y., $21,000 of stock was subscribed in aid of the proposed road from Troy to Averill Park, a distance of about 12 miles. WALTER P. WARREN, of Troy, is interested.

Mount Penn Switchback.—A press dispatch from Reading, Pa., states that the contract has been awarded for 600 tons of steel rails necessary to complete the road to the mills of the Pennsylvania Steel Co., at Steelton.

Lansing & Northern.—At a meeting of the incorporators recently held the following officers were elected: A. O. BEMENT, of Lansing, Mich., President; ISAAC HEWITT, of Maple Rapids, Mich., Treasurer; and QUINCY H. THOMAS, of Oxford, Mich., Secretary. The road is projected to run from Lansing north, via Maple Rapids and St. Johns, to a point on the lake. It is thought that sufficient local aid can be obtained to construct the road. The money has been raised to make preliminary surveys and work on these will commence at once.

SOUTHERN.—Existing Roads.

Louisville & Nashville.—Contracts for building 10 miles of the Big Stone Gap extension have been let by Engineer R. E. O'BRIEN. The first 2 miles, including a tunnel, 1,100 ft. long, was secured by Messrs. Mason, Hoge & King, Frankfort, Ky. Mr. R. J. McCrane, Lancaster, Pa., is the contractor for the remaining 8 miles. Both parties expect to finish their work by April 1, 1890. ——The contract for double-tracking the road between Edgefield and Edgefield Junction, has been let to Foster & Creighton, who will complete the work by Dec. 1.

Louisville, New Orleans & Texas.—Bart, E. Lineham, Dubuque, Ia., has secured the contract to build the line between Glendale and Lula, Miss.

Nashville & Knoxville.—Work upon this road is steadily progressing. The ballasting between Lebanon and Hickman has been completed, and is being rapidly pushed forward to Carthage. The grading is finished to about 10 miles west of Cookeville, and it is hoped to have the entire grade to that point completed in 90 days.

Louisville Southern.—Track has been laid from Versailles, Ky., east to the Elkhorn river on the extension from Lawrenceburg to Lexington, and is in progress west from Versailles toward the Kentucky river. Several miles has been laid from Lawrenceburg east toward the Kentucky river, and the entire branch will probably be completed by Aug. 15.

Nashville, Chattanooga & St. Louis.—It is rumored that this road will extend the branch from Wartrace, Tenn., on through to Petersburg in the near future, a work which has been contemplated for some time.

Eutawville.—The grading between Sumter and Pocatalgo swamp, a distance of 3 miles, has been completed.

Savannah, Americus & Montgomery.—According to President BAGLEY, 500 hands are at present employed grading the line east of McRae, Ga., towards the coast, and the route has been staked out from McRae to the Canoochee river, a distance of 65 miles, and the contracts let. After the grading has reached the Canoochee river, further construction to Savannah will be postponed, until that city gives an answer as regards the $50,000 subscription which it has been asked to raise.—— The company has also begun the survey of a branch road from Columbus to Eufaula, running parallel with the Chattahoochee river, a distance of 60 miles.

Central Railroad & Banking Co. of Ga.—A bill has been introduced into the Georgia Legislature, the import of which is to repeal the charter of the Savannah & Western Railway which is being built by this company. The bill seems to be the outcome of a dispute between the above mentioned company and the Savannah, Americus and Montgomery R. R. Co, as to their relative rights-of-way between McRae and the Canoochee river. Nevertheless it is stated that the firm of Wright & Strother are about to begin the work of grading from a point west of Eden, where it has already been finished, and proceed westward to the Ohoopee river, a distance of 40 or 50 miles. Capt. DABNEY, the engineer of construction, is making an examination of the route to determine the amount of bridge work necessary, the contract for which will be let as soon as possible.

Norfolk & Western.—This company proposes to build a 5-mile branch from their Cripple Creek division to iron mines to be developed by the New York & Virginia Mineral Co.

Chesapeake & Nashville.—Surveys have been completed from Harrodsburg, Ky., to Lancaster, and from Harrodsburg to Lebanon. The route between Muldraugh's Hill and Nashville, via Gallatin and Bowling Green, will be put under survey at once. Chief Engineer MCMICHAEL and President THOMSON expect to start the work of construction soon.

Farmville & Powhatan.—Seven miles of track have been laid from Clover Hill, northwest to Skinquarter, Chesterfield Co., Va. Grading has been finished for some time between Skinquarter and Powhatan, 56 miles, and track is now being laid.

Clarksburg, Weston & Glenville.—The contractor for changing this West Virginia road to standard gauge is A. M. Winsher, of Weston.

Kentucky Midland.—About 750 men are at work on the line between Paris and Georgetown, Ky., and it is expected to increase the force to 1,500.

Charleston, Cincinnati & Chicago.—Five hundred men have been added at Johnson City, Tenn., to the force employed on 90 miles of grading for this line.

Macon & Birmingham.—Contracts for building 100 miles of this road between Macon, Ga., and Birmingham, Ala., were awarded on July 15. Surveys are in progress between the Coosa and Tallapoosa rivers. W. H. WELLS, Macon, Ga., is chief engineer.

Alabama Midland.—The annual meeting of the stockholders of this road was held last week, and resulted in the election of the old Board of Directors, and of the following officers: O. C. WILEY, President; J. B. NEWCOMB, Vice-President; W. F. JOSEPH, Secretary; J. C. HENDERSON, Treasurer.——Reports from Gordon, Ala., state that between Ozark and the Chattahoochee river, the work of construction is progressing steadily, and that with the exception of a cut near Ozark, 8 miles long, containing 10,000 cu. yds., and an embankment of 2,500 cu. yds., the work is practically completed. There are also slight cuts and fills and a little grading to be finished in the vicinity of Newton and Dothen. Tracklaying is completed from the river to Gordon, 3½ miles, and west of Gordon 5 miles, and on the rest of the graded portions is being pushed forward as rapidly as possible. The trestle work is finished, and work on the iron bridge at the Chattahooche river is being pushed along night and day It is expected that the road will be completed to Ozark 52 miles, by Oct. 1, and by Jan. 1 will have been finished to Montgomery. Work on the Tuscaloosa extension will be begun at an early date.

Pensacola & Memphis.—S. N. VAN PRANG, of Pensacola, Fla., writes us that he is secretary of this company instead of president, as stated in our issue of June 22 and gives the following information regarding the road:

The line is to be built from Pensacola, Fla., to Memphis, Tenn., via Meridian, Miss. The distance of the line as projected and surveyed is about 419 miles. The distance from Pensacola to Meridian is 196 miles.

Ripley.—This railroad, extending from Middleton, Tenn., to Ripley, Miss., 24 miles, is to be sold at foreclosure sale at Ripley on July 23, by C. L. HARRIS, Trustee Commissioner. The line is the northern connection of the projected Gulf & Ship Island system.

Tobacco Belt R. R. Co.—WM. S. JORDAN, of Madison, Fla., General Manager of this company, states that the road is now in operation 8 miles, and is being constructed north 4 miles, via Belleville, Fla., to connect with the Georgia, Southern & Florida R. R. The company also intends to build south by Moseley Hall and Perry, Fla., to Deadman's Bayou or Cedar Keys, which will increase the mileage to 90 or 100 miles.

Richmond & Danville.—The last tunnel on the Western North Carolina extension between Asheville and Murphy has been completed, and it is expected to have trains running into Murphy in the near future.

Ohio River.—Roane Co., W. Va., has voted a subscription of $31,000 to aid in the construction of the Ravenswood, Spencer & Glendale R. R., and the town of Ravenswood has subscribed $3,000.

Richmond, Nicholasville, Irvine & Beattyville.—Chief Engineer J. H. PEARSON will receive proposals until Aug. 5 for the grading, tunneling, masonry, and trestlework on this road from Richmond to Beattyville, 57 miles.

Atlanta & West Point.—Brown & Lawrence, of Atlanta, Ga., have the contract for grading the extension from East Point to Atlanta, 6 miles. The road runs parallel to the tracks of the Central R. R. of Ga., over which the company now has trackage rights.

Cheraw & Darlington.—Steel rails have been laid on this road from Cheraw to Society Hill, and it is proposed to have them extend in the near future to Florence.

Savannah, Dublin & Western.—As stated last week, this road was sold at auction for $35,000 to B. A. DENMAR, a Savannah lawyer, who, it is supposed, represents Macon capitalists, who will complete the line. The Central R. R. of Georgia also bid upon it, and President ALEXANDER of that company states that he thinks it will ultimately pass into their hands.

Wadley & Mount Vernon.—Grading has begun on this Georgia road between Wadley and Mount Vernon, 50 miles. The company has purchased 14 miles of 56-lb. steel rails.

Georgia Southern & Florida.—Tracklaying is about to begin at Palatka, to which point grading has been completed.

East Tennessee, Virginia & Georgia.—A new issue of 5 per cent. second mortgage bonds, limited to $6,000,000, has been made by this company for the purpose of the improvement and additional equipment of the property.—Work has begun on the remodeling of the Memphis and Charleston bridge across the Tennessee river. Two new stone piers will be built, and a draw span 412 ft. long will be put in; the work is expected to occupy nearly a year.

Monongahela River.—The Monongahela Coal & Coke Co. intends to open its mines and erect its coke plant along the line of this road as soon as possible. President, D. S. THOMSON and Engineer VICTOR HAGMANN are using every possible means to push work. In and around Briartown, W. Va., two of the proposed coke plants have already been located, and plans and specifications have been prepared for the houses of the mining town, which has been laid out at that place. Bennet & Talbott have been awarded the contract for 500 of the coke ovens.

Projects and Surveys.

Tampa & West Coast.—The surveys for this road, which is projected to run from Tampa, Fla., to Sutherland, on the Gulf coast, are now in progress under the direction of E. B. CARTER, Chief Engineer. The road will traverse a rich section of the State.

Bowling Green & Northern.—The contracts for grading this road from Bowling Green to Scottville, Ky., 65 miles, will be let immediately. W. H. CRUMP, of Bowling Green, is Secretary.

Paducah & Tennessee.—The city of Paducah, Ky., has voted $50,000 in aid of this enterprise on condition that work be commenced at once. It is stated that McIntyre & Concannon, contractors, will begin grading as soon as part of the line has been located. The road is projected to run from Paducah to Paris, Tenn., a distance of 65 miles.

West Florida & Alabama.—J. D. PIRRONG, of Wewahitchka, Fla., President, sends us the following information:

This road is to run from Chipley, Fla., via St. Andrews, Wewahitchka, St. Joseph and Appalachicola to the Alabama State line, 158 miles. The road will ultimately be continued north to Eufaula, Ala. Surveys will commence in 60 days. The road will pass through a fine timber and agricultural country well adapted to fruit growing. There will be a large passenger traffic to and from St. Andrews and St. Joseph. No right-of-way has been secured, but 7,500 acres of land per mile has been granted by the State, and a large amount of local aid in subscriptions has been secured.

Missouri, Tennessee & Georgia.—This road is projected to run from Humboldt, Tenn., through the counties of Gibson, Albion and Lake, in Tennessee, and Fulton, Ky., to a point on the Mississippi river. The preliminary surveys have been completed and locating surveys will commence in about 6 weeks. The road will pass through a good timber and farming country. The entire right-of-way has been secured. L. B. WRIGHT, of Humboldt, is President, and J. J. WILLIAMS is Chief Engineer.

Melon Belt.—Dr. E. A. JELKS, of Quitman, Ga., has applied to the legislature for a charter to build a railway from Quitman to Adel, Ga., a distance of about 25 miles.

Montgomery Belt.—Organized to build a belt line railway around Montgomery, Ala. Contracts are reported let. W. F. JOSEPHS, of Montgomery, is interested.

Birmingham, Mobile & Navy Cove Harbor.—It is stated that arrangements have been made for the construction of this road. THADDEUS MCNULTY, of Mobile, Ala., is General Manager.

Memphis & Raleigh.—A project is on foot to build a line of railway from Memphis to Raleigh, Tenn., a distance of about 10 miles. Among the incorporators are W. J. CRAWFORD and W. B. MALLORY, of Memphis.

Hawkinsville, Empire & Dublin.—This road, which is projected to run from Hawkinsville, Ga., to a connection with the Georgia Southern & Florida R. R., 18 miles, has been located, and it is expected that construction will begin soon. J. D. STETSON, of Hawkinsville, is President.

Georgia.—Bills have been introduced into the Georgia State Legislature incorporating the Hawkinsville & Florida Southern and the Waycross Air Line railway companies.

NORTHWEST.—Existing Roads.

Northern Pacific & Manitoba.—Tracklaying has commenced on the Morris-Brandon branch, and 12 miles are already completed. It is expected that 40 or 50 miles of the road will be completed this month. This portion will be opened for traffic as soon as completed.

Chicago, Rock Island & Pacific.—A press dispatch from Omaha, Neb., states that this company is considering the building of a branch from Omaha to Fairbury, where a connection will be made with the Chicago, Kansas & Nebraska branch. Surveys will begin immediately, and as soon as sufficient progress has been made grading will commence.

Louisville, Evansville & St. Louis Consolidated.—A mortgage of $8,000,000 has been made to the New York Security & Trust Co., and Jos. COLLETT, of Terre Haute, Ind., secured on all the existing property of the company. The money will be used in building proposed extensions and making other improvements.

Chicago, Burlington & Northern.—A dispatch from Red Wing, Minn., states that surveys are now in progress for a branch from the main line via Red Wing, westward.

Projects and Surveys.

Missouri River, North Platte & Denver.—At a meeting of the stockholders recently held, the following officers were elected: President, LORAN CLARK, of Albion, Neb.; Vice-President, F. C. PATTERSON, and F. H. SMITH, Secretary. The road is projected to run from Albion to Denver, Col., a distance of 450 miles. Surveys are now in progress under the direction of J. W. ANDREWS, of Albion, Chief Engineer.

Yankton, Norfolk & Southwestern.—Twenty-five proposals for building this line from Yankton, Dak., to Norfolk, Neb., 70 miles, have been received. Work is to begin July 16.

Port Arthur, Duluth & Western.—It is announced that Port Arthur, Ont., has voted a large bonus in aid of this enterprise. The road is projected to run from Port Arthur to the International boundary, a distance of 85 miles. THOS. MARKS, of Port Arthur, is President.

Winnipeg & Southeastern.—It is reported that Egan Bros. have the contract for building a portion of this road. This is the Canada division of the Duluth, Rainy Lake River & Northwestern R. R., which is projected to run from Duluth to Winnipeg.

Midland Pacific.—The engineers who are surveying this line from Pierre, Dak., to Puget Sound, have reached Buffalo, Wyo., and are now at work in the Big Horn mountains.

Duluth, Crookston & Northern.—It is announced that negotiations have been concluded whereby this company has obtained the capital necessary to complete its line. It is expected that construction will begin at once. The road was projected to run from Duluth, Minn., northwest through the city of Crookstown to the International boundary, with branches from Crookston west to the Red River and from Crookston south to Brainard. E. W. LEWIS is engineer in charge of construction with offices at Crookston.

Abbotsford & Northeastern.—It is announced that work is now in progress on this line. P. S. LAY & Co., of De Pere, Wis., are the contractors.

Chicago, Peoria & St. Louis.—A certificate has been filed with the Secretary of the State of Illinois consolidating the Peoria, Springfield & St. Louis and the Chicago, Peoria & St. Louis railways. The capital stock of the consolidated line is $2,500,000. Among the directors are: I. L. MORRISON, of Jacksonville, Ill., and WM. T. BURON, of Lafayette, Ind.

Wisconsin Midland.—We are indebted to N. BOARDMAN, of Fond du Lac, Wis., Consulting Engineer, for the following information concerning this enterprise:

The company was incorporated in March, 1887, to build lines of railway from Fond du Lac north to L'Anse, Mich., a distance of 223 miles, and from Fond du Lac south to Chicago, a distance of 144 miles. This was to be known as the main line. Branches were also to be built from Kaukauna, Wis., to Sturgeon Bay, 72 miles, and from Fond du Lac to Madison, Wis., 69 miles. The total length of the road will be 513 miles, and of this 349 miles, including all of the mileage in Wisconsin, has been surveyed, and estimates, profiles and maps prepared. The line passes through some of the best timber land in Wisconsin, crosses the Marquette and Gogebic iron mineral ranges and enters the copper region of Lake Superior. Bonds to the amount of $61,000 have been voted by the towns along the route. A large portion of the road traverses a region practically unknown to railways. The officers of the company are: C. H. BENTON, Vice-President and acting President; DANA C. LAMB, Secretary, and G. A. KNAPP, Treasurer, all of Fond du Lac.

Sioux City & Northern.—A press dispatch from Sioux City, Ia., states that active work of construction has been commenced. The road was projected to run from Sioux City to Flandreau, Dak., a distance of 120 miles. L. F. WAKEFIELD, of Sioux City, is Chief Engineer.

SOUTHWEST.—Existing Roads.

Kansas City, Watkins & Gulf.—A correspondent has furnished us with the following information concerning this enterprise:

The contract for grading 40 miles of this road has been let to Kennedy & Stone of Topeka, Kan. It is expected that tracklaying will begin about Oct. 1, and this portion of the road be opened for traffic two months later. The right-of-way has been secured and other local aid obtained. Surveys have been completed for 200 miles. The route passes through some of the finest timber country in the Southwest and for the greater part of the distance is almost level. The principal business will be in lumber, corn, cotton, sugar, rice and fruits. J. B. WATKINS is President, and P. H. PHILBRICK is Chief Engineer; both of Lake Charles, La.

Harold, Garden City & Southwestern.—E. H. BARTON, Secretary, of Jetmore, Kan., sends us the following:

This company was incorporated in September, 1888, in the interest of the Omaha, Dodge City & Southern R. R., to build a line of railway from Harold, via Kiddersville and Ravenna to Garden City, Kan. Surveys will commence in the spring of 1890. The route is along the valley of the Pawnee river, which affords very easy grades. The principal business of the road will be in coal, lumber and farm produce.

San Antonio & Aransas Pass.—Geo. B. Hurly, of Waco, Tex., has the contract for grading 52 miles of this line from Waco to Cameron. Work is to begin at once.

Houston, East & West Texas.—This company, which operates a railway from Houston, Tex., to Logansport, La., 192 miles, will issue bonds amounting to $18,000 per mile. The money is to be used in changing the road to standard gauge.

Dallas, Pacific & Southeastern.—It is expected that the grading will be completed from Dallas to Rhome, Tex., 70 miles, by August 1.

Chicago, Kansas City & Texas.—About 7 miles of this suburban road from Kansas City north to Nashua, Mo., has been completed. Work is now in progress on the remaining 2 miles.

Projects and Surveys.

Nebraska, Kansas & Southwestern.—Incorporated in Kansas with a capital stock of $2,225,000 to build 250 miles of railway in that State within the next year. The headquarters of the company are at Hutchinson.

ROCKY MT. AND PAC.—Existing Roads.

Northern Pacific.—This company has laid track from Laurel, Mont., to Red Lodge, Mont., 43.7 miles; from Wallace, Idaho, to Mullan, 7.1 miles and from end of track south of Orting, W. T., to Puyallup river, 3.8 miles, and to Davenport, W. T., 3.3 miles, since Jan. 1, 1889. The lines from Little Falls, Minn., to Staples Mill, 33 miles, and from Minnewaukan to Leeds, Dak., 18 miles, are now under construction. Winston Bros. of Minneapolis, Minn., have the contract for the former and Ed. McCormick, of St. Paul, for the latter. Surveys are now in progress on the lines from Fort Benton, Mont., to Billings, Mont., 225 miles, from Boulder to Elkhorn, Mont., 21 miles, and from Sappington to Pony, Mineral Hill and Sterling Mines, 25 miles. Construction will begin on the last two lines soon.

Silverton.—Construction has been commenced on the line from Silverton to Eureka, Colo., 8 miles.

Seattle & Northern.—About 800 men are now at work on this road and grading is being pushed at the rate of two miles per day. Capt F. A. HILL, of Seattle, W. T., has charge of the work.

Southern Pacific.—This company denys the report that the building of an extension to Astoria, Ore., is contemplated.—Work is being pushed on the line from Monterey to Pacific Grove, Cal.

Denver & Rio Grande Western.—A press dispatch quotes an official of this road as saying that surveys have been made from Salt Lake to the California State line, running parallel to the Central Pacific R. R. on a line about 200 miles south. A very favorable line has been secured and as soon as satisfactory arrangements can be made construction will commence.

Oregon Ry. & Navigation Co.—Work is being pushed on the extension to Mullen, Idaho.

Port Townsend Southern.—The citizens of Chehalis, Wash., have granted this company free right of way into the city. It is expected that the location of the line will be resumed and the road be immediately pushed to completion.

Projects and Surveys.

Utah Western.—It is stated that construction has commenced on this road which is to run from Buck's Hot Springs to Salt Lake, Utah.

FOREIGN.

Mexican National.—This company expects to have the line from San Miguel to Laredo completed within 18 months. The large machine shops at Laredo costing $600,000 are nearly completed. Orders have been given for 500 new freight cars of 40,000 pounds capacity each, and to the Baldwin Locomotive Works for 15, 72-ton consolidation locomotives.

Mexican Pacific.—Engineers are now at work on the surveys for the line westward to the Pacific coast at Tonala. A short distance of the road from Tonala east has been located and it is stated that contracts will be let soon. J. C. OLIPHANT, of Tonala, is Chief Engineer.

Monterey & Mexican Gulf.—The line from Monterey to Montemorelos, a distance of 56 miles, is reported completed and will be opened for traffic soon. Engineers are now at work on the extension from Monterey to Benedicto.

Deming, Sierra Madre & Pacific.—Tracklaying is now in progress and it is expected to have the line from Deming, N. M., to Los Palomas, Mex., completed by Sept. 23. The road will ultimately be continued along the eastern slope of the Sierra Madre mountains to Guerrevas and thence north to Guaymas.

Guatemala, Central America.—The railway running between Champerico and Retalhuen, about 30 miles long, has been sold by the former owners to a native syndicate composed of "Hijos del País;" the formal transfer was made June 20. The new owners contemplate an extension from Retalhuen to San Feilpe, a distance of about 16 miles. ADOLFO MEYER is Managing Director of the new company, and Baron VON HIPPEL is Superintendent; they succeed Mr. SANFORD ROBINSON and Mr. H. W. GARDNER respectively.

RAPID TRANSIT.

Street Railways.—***Buffalo, N. Y.***—The franchise for line on Clinton St. will be sold at auction at the City Hall on July 29. The line is to be double track throughout, or double track part of the way, and single track with turnouts for the balance; it is to be laid with girder rails. For particulars address JOSEPH E. BARNARD, City Comptroller.

Syracuse, N. Y.—A franchise has been granted to the People's Ry. Co. It will build a single track line, with turnouts, and the track will be of side-bearing rails.

Hamburg, N. Y.—A street railway is projected. Mr. VAN ETTEN, of Buffalo, Superintendent of the New York, Lake Erie & Western Ry. Co., is interested.

Pittsburg, Pa.—The South Side Traction Co. has been incorporated to build a line 8 miles long, crossing the Monongahela river.

Macon, Ga.—The Macon street railway has been sold to Mr. GEO. WORK, of Philadelphia, for $60,000.

Gainesville, Fla.—The Gainesville & Suburban Ry. Co. will commence work shortly.

Lancaster, O.—The Lancaster Street Ry. Co. will receive bids until July 29 for the purchase of $15,000 first mortgage bonds. Proposals for material and construction will be opened the same day.

Elevated Railway.—***Chicago, Ill.***—The Hannahs Ry. Co. has been incorporated to build a line on the Hannahs patent system to West Chicago, Jefferson and Lake. The incorporators are J. M. HANNAHS, THOMAS RANKIN, and D. V. PURINGTON. Capital stock, $2,000,000.

Electric Railways.—***Boston, Mass.***—The West End Street Ry. Co. has received permission from the Railroad Commissioners to adopt overhead wires for operating any of its lines. The company has purchased the property of the Hinkley Locomotive Co. and will establish an extensive power house.

Saratoga, N. Y.—The Saratoga Electric Ry. Co. has been incorporated by GEO. W. MORTON, JAMES H. PARDUE and DENMAN VAIL, of Saratoga, W. B. FERGUSON, of Boston, and J. M. BURT, of Bennington, Vt. Capital stock, $50,000.

Pittsburg, Pa.—The Pittsburg & Wilkinsburg Street Ry. Co. has been incorporated by W. W. YOUNG, W. G. HASTINGS, and JAMES FITZSIMMONS. Capital stock, $30,000.

Savannah, Ga.—The Savannah Belt Ry. Co. proposes to operate its line by electricity.

Bryson City, N. C.— Equipment for an electric railway is wanted by B. B. LAKE.

Cleveland, O.—The Broadway & Newburg Street Ry. Co. has applied for power to adopt electric traction.

Belleville, Ill.—The Citizens' Railway Co. has applied for power to substitute electricity for horses.

Peoria, Ill.—The contracts for the power house have been let to W. Allen, at $9,050 for the brickwork, and Joseph Miller & Sons at $17,000 for the woodwork.

Des Moines, Ia.—The street railway has been bought by a Chicago syndicate for $350,000. It is said that when operated by horses it did not pay expenses, but since its equipment with the Thomson-Houston electric system its net earnings pay an 8 per cent. dividend.

Pittsburg, Kan.—The Pittsburg Electric Light & Railway Co. has been incorporated by B. T. HOBART, of St. Louis; C. E. GRANNIS, of New Haven, Conn.; B. H. WILSON and T. RAMSEY, of Pittsburg, and A. E. STILLWELL, of Kansas City. Capital stock, $500,000.

Cable Railways.—***Beaver Falls, Pa.***—A company has been organized by local and Pittsburg capitalists, to construct a cable line from College Hill to New Brighton.

Baltimore, Md.—The system of the Baltimore Cable Ry. Co. will be operated by several cables, driven from two separate power houses, with engines of 1,000 H. P. The city cables will have a speed of 5 miles an hour, and the suburban cables will have a speed of 10 miles an hour.

Cleveland, O.—The Superior St. Ry. Co., and the St. Clair St. Ry. Co. have applied for power to operate their lines by cables.

CONTRACTING.

Subway.—The contract for the construction of the iron work for the King St. subway, at Toronto, Ont., has been awarded by the Committee on Works to the Hamilton Bridge & Tool Co. for $84,666.

Piles.—The following proposals for 670 yellow pine, Norway pine, cypress, or spruce piles were received recently by the Docks Department, New York City: Beard & Kempland, $6.50 for 55 to 60 ft. piles, $7.60 for 60 to 65 ft., $9.20 for 65 to 70 ft. $10.75 for 70 to 75 ft A. J. Murray, $7, $8, $9.50, $11. The contract was awarded to Beard & Kempland.

Levees.—The following contracts have been awarded by the Mississippi Levee Commissioners, Greenville, Miss.: New levee: Halls Landing levee, F. M. Sullivan, Memphis, Tenn., 11¼ cts. per cu. yd. for 175,000 cu. yds. of embankment. Repairs: Dennis to Sledges, Flynn & Cook, Memphis, Tenn., 14¼ cts. for 49,140 cu. yds.; Sledges to Concordia, W. C. Boyd, Concordia, Miss., 14 cts. 30,610 cu. yds.; Arnolds to Stokes, Thos. Foley & Co., Memphis, Tenn., 15½ cts. for 63,150 cu. yds.; Stokes front, W. R. Harvey & Co., Memphis, Tenn., 19 cts. for 42,460 cu. yds.; Reserve to Shipland, W. R. Harvey & Co., Memphis, Tenn., 16 cts. for 38,370 cu. yds.; Shipland to Fitlers, J. L. Perkins, Greenville, Miss., 15 cts. for 33,550 cu. yds. WM. STARLING is Chief Engineer, and ROBERT SOMERVILLE, Acting Chief Engineer.

Macadam. — At Huntsville, Ala., the County Commissioners have awarded the contract for macadamizing 40 miles of public roads to Darnell & Lane, of Greencastle, Ind., at $2,000 per mile.—At Alton, Ill., the contract for furnishing macadam has been let to Henry Watson, at $6.25 per square.

Sewer Pipe.—***Helena, Mont.***—The following bids have been received by the City Council for 8, 9, 10, 12, 15, and 18-in. pipe: Helena Cement Works: 24, 28, 33, 40, 52, and 70 cts. per ft. for Portland cement pipe, connections 40 cts. each. Monmouth Vitrified Pipe Works: 28, 35, 42, 52, 71 cts., and $1.06 for pipe; $1.09, $1.36, $1.64, $2, $2.77, and $4.16 for Ys. St. Louis Vitrified Pipe Works: 27½, 32½, 42, 50, 68, and 98 cts. for pipe; 76, 90 cts., $1.17, $1.44, $2.96, and $2.85 for Ys.—The bids for brick were as follows: Helena Pressed Brick Co., $9.95, $8.65 per 1,000; N. Kessler, $9.75; S. T. Porter, $9.65.—The only bid for manhole covers and drip basins was from R. Coughlin, $15.95 for the brick work and $6.05 for the iron cover.

Washington, D. C.—The District Commissioners have awarded contracts as follows: American Sewer Pipe Co., terra cotta pipe; 15,000 ft. of 12-in. at 16 cts., 1,000 ft. of 15-in. at 25 cts., 3,040 ft. of 15-in. at 34 cts., 23,000 ft. of 24-in. at 97 cts., 2,000 ft. of 12-in. at 38 cts.; 300 ft. of 4 x 6-in. branches at $1.50. Thos. Somerville & Sons: terra cotta pipe, 500 ft. of 6-in. at 6 cts., 500 ft. of 8-in. at 9 cts., 10,000 ft. of 12-in. at 16 cts., 2,000 ft. of 13-in. at 25 cts., 2,000 ft. of 18-in. at 34 cts., 2,000 ft. of 24-in. at 62 cts., 175 ft. of 8 x 6-in. branches at 20 cts., 2,000 ft. of 12 x 6-in. branches at 20 cts. A. Lamond: 500 ft. of 6-in. at 6 cts., 500 ft. of 8-in. at 9 cts., 20,000 ft. of 12-in. at 15½ cts., 500 ft. of 15 x 6-in. branches at 61 cts.

Baraboo, Wis.—The Stone Ware Sewer Co., of Alton Junction, Ill., has been awarded the contract for pipe for the new sewers.

Sewers.—***Ware, Mass.***—The following are the prices of the contract mentioned last week as having been awarded to M. Sullivan & Co., of Little Falls, N. Y.: laying 5, 6, 8, 9, 10, 12, 15, and 18-in. pipe, 2 cts. per ft.; 100 manholes, $43.50 each, the iron head being furnished by the town; excavation, from 17 cts. per ft. for 6 ft. deep, 25 cts. for 6 to 8 ft., 37 cts. for 8 to 10 ft., 85 cts. for 10 to 12 ft., $1.10 for 12 to 14 ft., $1.50 for 14 to 16 ft., and $1.75 for 16 to 18 ft.; rock excavation, $2.25 per cu. yd.; catch basins, $43.50 each, the head being furnished by the town; sheeting left in trenches, $17 per 1,000 ft. B. M.; timber in foundations, $21 per 1,000 ft. B. M.; concrete, $4.50 per cu. yd.; rubble masonry, $4.50 per cu. yd.; extra brick work, $7.50 per cu. yd.; total, $19,494. The town will furnish pipe and cast-iron heads for manholes. The present outlet will be the Ware river, below the village. The locality is favorable for irrigation or purification by filtration if it should become necessary. FRANK L. FULLER, of Boston, is the engineer.

Sioux City, Ia.—The following proposals have been received for sewers on the West Side: M. L. Flinn, $8,932.09; Louis Kettleson, $9,226.24; Miller & Patterson, $10,093.58; W. P. Whitten, $10,897.02; M. O'Neil, $12,501.02; Kimball & McNamara, $14,043.16. The prices of the lowest bid ranged from 47¼ cts. per ft. for 8-in. pipe to 86¼ cts. per ft. for 12-in. pipe.

Willimantic, Conn.—The following were the bids for the sewer on Church, Union, and Center Sts.: A. Brazos & Son, Middletown, Conn., $4,000.20; Robert Fenton, Willimantic, $3,780.02; George M. Aitkins, Palmer, Mass., $3,724.20; Edward McManus, Waterbury, $3,550.90; V. L. Raymond, Brooklyn, N. Y., $3,460.30. Mr. Raymond was the lowest bidder, but as he did not comply with all the requirements of the contract, it was awarded to Mr. McManus of Waterbury. Aside from the regular bid the contract says $4 per yd. will be allowed for all rock excavation.

Street Work.—***Camden, N. J.***—The street committee has awarded contracts as follows: Thos. A. Wilson, 30 cts. for 16-in. flagging, 28 and 55 cts. for 10 and 20 in. crossing stone, 17 cts., for 10-in. gutter stone. B. F. Sweeten, $49 and $50 for manholes and $1 per ft. for 18-in. terra-cotta pipe.

Baltimore, Md.—The City Commissioner has awarded the following contracts for Belgian blocks and 6-in. granite curbing: 50,000 blocks at $52 per 1,000, 53,000 at $59.75 and 2,600 ft. of curb at 75 cts. per ft., to the Woodstock Granite Co.: 50,000 blocks at $58.95, 50,000 at $60, and 1,000 ft. of curb at 74 cts. per ft., to William F. Weller; 50,000 blocks at $62 per 1,000, to William E. Carey.

Omaha, Neb.—The following proposals have been received for cypress block paving, including sand, boards, and curbing. J. E. Riley & Co., per sq. yd., curbing per lin. ft., 4 ins. of sand and board, $1.57; concrete, $1.88; curbing, 94 cts. William McHugh: concrete, $1.89; sand and board, $1.60; curbing 97 cts. P. H. Maloney; concrete, $1.99; sand and board, $1.68; curbing, 99 cts.: Masson & Stanbury: concrete, $2.48; sand and board, $1.74; curbing, 99 cts. The contract was let to Riley & Co.

Sewers.—***Clifton, O.***—The following contracts, *F*, *G*, *H*, and *J*, for the construction of the new sewers, have been awarded by the engineer, A. S. HOBBY, of Cincinnati. The following is a list of the bidders, all of whom are local contractors: Eugene Buckley, P. Murray & Son, E. J. Nealis, A. W. Davis, Henkel & Brehm, Thomas Howard, Henry MacErlane, M. Peter, B. D. Barton, Martin Byrnes, M. T. Flynn, Benj. Barton, John E O'Brien, John Scully, Joseph Conion, Folz & Jonte, and R. J. Huston.

Contractor.	12-in. Sewer per lin. ft.	15-in. Sewer per lin. ft.	6-in. House Connections.	12-in. Y's each.	15-in. Y's each.	Manholes each.	Rubble Masonry per cu. yd.	Concrete per cu. yd.	Timber in Foundations per 1,000 ft. B. M.	Sheeting left in Trenches per 1,000 ft. B. M.	Brickwork in Cement per cu. yd.	Total
F. M. Peter,	$ 1.05	.....	$ 0.90	$ .90	.....	$ .29	$ .50	$ 1.00	$ 1.00	$ 5.00	$ 1.00	$ 1,532.50
G. Martin Byrne.	1.08	.....	.75	2.92	.....	.25	4.00	5.00	20.00	16.00	9.00	1,357.44
H. John E. O'Brien.	1.00	.....	.70	.95	.....	.25	3.75	3.75	12.00	12.00	7.00	1,732.50
J. John E. O'Brien.	.90	1.10	.60	.95	1.40	.18	3.75	3.50	12.00	12.00	7.00	6,056.70

Brick Paving.—***Newark, O.***—The following proposals were received recently by the city clerk. Paving complete per sq. yd. with foundation: John O. Bates, $1.30; E. A. Freshwater, $1.30; J. M. Todd, $1.40; C. B. Boren, & Co., $1.29; Frank Nicholson and W. F. Ottis, $1.37; C. H. Connell and Herring & Straub, $1.20; F. Vogelmeier, $1.65. Paving per sq. yd., without foundation; F. Vogelmeier, $1.65; Herring & Straub, $1.24; C. H. Connell, $1.03. John O. Bates, 12 cts.; C. B. Boren, 10 cts.; J. M. Todd, $1.25; E. A. Freshwater, $1.08. Preparing foundation ready for pavement, per sq. yd.: John O. Bates, 21 cts; E. A. Freshwater, 93 cts.; J. M. Todd, 25 cts.; G. B. Boren, & Co., 30 cts.; C. H. Connell, 20 cts.; Samuel J. White, 97 cts.; Herring & Straub, $1.20; F. Vogelmeier, 40 cts. Furnishing fire-brick on premises neatly piled up, per sq. yd.: F. Vogelmeier, $1; Herring & Straub, $1.20; C. H. Connell, 95 cts.; John O. Bates, $1; G. B. Boren & Co., 99 cts.; J. M. Todd, $1.10; John Tucker, 90 cts.

PROPOSALS OPEN.

Pipe.—About 730 tons of cast-iron pipe. JOHN ROBINSON, Secretary, Water Commission, Niagara Falls, Ont.

Court-House.—Plans and specifications are to be advertised for. THE CHAIRMAN OF THE BOARD OF SUPERVISORS, Beatrice, Neb.

Paving.—Bids for paving will be advertised for. THE PAVEMENT COMMISSION, West Troy, N. Y.

Street Work.— Foundation, granite block paving, limestone curbing. THE BOARD OF PUBLIC AFFAIRS, Cincinnati, O. July 27.

Roads.—Regulating, grading, and Telford and macadam paving on the Flushing and North Hempstead turnpike. Distance, 29,325 ft., or, in two sections, 6,350 ft.

and 14,225 ft. Specifications on file. SAMUEL HOOPER, Town Clerk, Roslyn, L. I. July 30.

Jail.—Work complete, or separate bids for steel and iron work. Architects, ORLOPP & KUSENER, Little Rock. Capt. P. H. WHEAT, Commissioner of Public Buildings, Lonoke, Ark. July 31.

Bridge.—Iron bridge, 120 ft. span, 16 ft. roadway. D. W. NORTON, Commissioner, Pinkstaff, Ill. July 31.

Water Supply.—Complete system; 20 miles of mains and 20 hydrants. Contract for 1 to 15 years. THE WATER COMMITTEE, Helena, Mont. August 1.

Electric Light Plant.—At the Washington navy yard, THE COMMANDANT OF THE NAVY YAYD, Washington, D C., August 6.

Pipe.—Cast-iron pipe, 430 tons of 24-in., and 2,780 tons of 24-in.; 12-ft. lengths, 2,774 lbs. per length, 0.88 in. thick. Bids per ton of 2,000 lbs. Also 4½ miles of double riveted steel or iron pipe from the city to the pumping station on Willamette river; 24-ins. diameter, 0.165-in. thick (No. 8 B. W. G.). The price must be stated per lb. for the classes of iron stamped C No. 1, 45,000 T. S., and C. H. No. 1, 50,000 T. S., and for shell steel 50,000 T. S. Proposals may be made separately for furnishing the material f. o. b. cars in the city of Portland, and for the manufacture of the pipe jointed and laid in the ditch, which will be excavated and prepared at the expense of the water committee. The proposals may also be made for materials and manufacture. ISAAC W. SMITH, Superintendent of City Water-Works, Portland, Ore. August 6.

Electric Lighting.—For a term of 5 years; 41 arc lights of 2,000 c. p. on poles and mast arms. J. H. MILLER, City Clerk, New Castle, Pa. August 10.

MANUFACTURING AND TECHNICAL

Material Wanted.—Gilhan & Langhorne, of Lewiston, W. Va., want a saddle-tank, narrow-gauge locomotive, 7½ tons; also 25-lb. rails.

A second-hand steam pump with capacity of 2 to 10 gails. per minute, and second-hand boiler, 22 to 26 ft. long, 38 to 44 ins. diameter, are wanted by the Woodward C. & M. Co., Huntsville, Mo.

A second-hand Blake crusher, large size, 12-in. jaws, is wanted. Address 09, *Globe Democrat* office, St. Louis, Mo.

A second-hand vertical steam engine, 4 H.P., is wanted by W. W. Hamilton, Hockley, Tenn.

Rails and spikes are wanted by Peter Graham, Prairie Grove, Ark.

Rails and rolling stock are wanted by the Indian Spring & Flovilla Dummy Line Co., of Flovilla, Ga.

A 20 H. P. stationary engine and 20 H. P. boiler are wanted. Address P. O. Box 284, Richmond, Va.

Locomotives.—The Manchester Locomotive Works, of Manchester, N. H., are building 8 engines for the Concord road.

The Schenectady Locomotive Works, of Schenectady, N. Y., are building 25 engines for the East Tennessee, Virginia & Georgia.

Cars. — The Pullman Car Co., of Pullman, Ill., has delivered several of the 50 cars ordered for the Atlantic City division of the Philadelphia & Reading.

The Barney & Smith Mfg. Co., of Dayton, O., is building 25 passenger cars for the New York Central.

The Indianapolis Car Co., of Indianapolis, Ind., has built 100 freight cars for the Jacksonville Southeastern.

The Peninsular Car Works, of Detroit, Mich., have shipped 25 freight cars to the Fairhaven Southern. They are equipped with air brakes and Janney couplers.

The St. Charles Car Co., of St. Charles, Mo., has turned out 12 cabooses for the Oregon Ry. & Navigation Co., and is building box cars for the Iron Mountain & Southern.

Gas Engines.—The Van Duzen gas engine is claimed to possess considerable advantage by the methods of the proper admixture of air and gas and the ignition of the mixture. The engine is of the vertical type with the cylinder over the crank shaft; the base forms a reservoir for the oil and water which continuously lubricate the working parts; there is a fly-wheel at each end of the crank shaft. Direct-acting poppet valves are used and a special form of governor, operated directly from the shaft, which controls the gas and air valve and the speed of the engine; this governor ensures that the air entering the cylinder is mixed with its proper proportion of gas. The proportions of gas and air do not vary, and they are thoroughly mixed before entering the cylinder; the charge is compressed previous to explosion and is exploded while very hot by direct contact with a flame of gas, the ignition being certain. The consumption of gas is regulated by the load on the engine. The engines are from 1 to 10 I. H. P., costing $325 to $1,075, and are in extensive use. They are manufactured and sold by the Van Duzen Gas Engine Co., of Cincinnati, from whom descriptive pamphlets and all information may be obtained.

An Automatic Indicator Bolt, of simple construction and reliable in work performed, is invented by Mr. JOHN D. VAIL, of Blairstown, N. J. It is for use in bathrooms and water-closets, in cars, hotels, steamers, etc. By an eccentric working with the bolt, the words "vacant" or "occupied" are made to appear as the case may be. It is neat in appearance, serves a useful purpose, and costs $1.50 retail.

Bridge Masonry.—*Parkersburg, W. Va.*—The following proposals for the substructure of a highway bridge over the Little Kanawha river have been received by the Commissioners of Wood County. The contract was awarded to Bick & Glaun.

Bidders.	Concrete per cu. yd.	1st class masonry per cu. yd.	2d class masonry per cu. yd.	Foundations under water per cu. yd.	Dry foundations per cu. yd.	Earth filling, per cu. yd.	Foundation timber per 1,000 ft. B. M.	Crib timber per 1,000 ft. B. M.	Foundation piling in place per lin. ft.	per yard for 500 yds. 1st class stone belonging to county.	per yard for 500 yd. 2d class stone belonging to county.
Milligan & Blodgett, Parkersburg, W. Va.	5.25	7.98	5.50	1.00	25	..	29.50	29.50	30	....	....
D. Moynahan, Youngstown, O.	4.50	7.75	6.00	1.00	25	25	24.00	24.00	35	2.67	2.00
P. H. Kelly & Co., Portsmouth, O.	4.75	7.90	5.90	1.00	26	26	24.50	24.50	35	2.00	2.00
Shipman & Richardson, Portsmouth, O.	4.00	7.25	6.25	1.10	25	35	24.00	27.00	26	3.00	3.00
Bick & Glaun, Toledo, O.	5.00	7.85	5.75	1.00	25	40	20.00	20.00	28	3.00	3.00
P. Q. Shrake & Bro., Friendly, W. Va.	5.00	7.50	4.50	1.25	25	30	25.00	25.00	30	1.50	1.50
Dellicker & Jolly Bros. Parkersburg & Pittsburg, Pa.	5.25	7.15	6.65	1.25	25	20	28.00	30.00	25	3.00	1.00

The Famous Johnstown Bridge, that stood the rush of waters from the South Fork Dam, which destroyed every other work of man in its path, was built of the ordinary mountain sandstone, laid up in the ordinary "Union" cement, manufactured by Messrs. Lesley & Trinkle, of Philadelphia. The mortar was 2 parts sand to 1 of "Union" cement. The bridge was built in 1887-88, by Messrs. Sparks & Evans, of Philadelphia, and is a credit to their good workmanship and to the materials used.

Trade Catalogues.—The Champion Blower & Forge Co., of Lancaster, Pa., has issued an illustrated catalogue of different kinds of blowers, fans, forges, drills, tire benders, etc. Prices, dimensions, and capacities are given.

Copeland & Bacon, of New York, have issued an illustrated catalogue of hoisting engines, boilers, iron coal cars and buckets, and contractors' supplies. Also the Farrell & Marsden stone and ore crushers, Blake pattern.

The Pond Engineering Co., of St. Louis, Mo., has issued an illustrated catalogue of pumping machinery and plant for water-works.

The Abendroth & Root Mfg. Co., of New York, has issued an illustrated catalogue of spiral riveted pipe, pipe fittings, and the Root water-tube boiler.

Gas Compressors.—The Clayton Air Compressor Works, of New York City, have the contract for 2 duplex gas compressors and boilers for the Kentucky Rock Gas Co. They have a daily capacity of 2,000,000 cu. ft. and are to compress the natural gas at the wells to a pressure of 200 lbs. per sq. in., and force it to Louisville, 32 miles, for light and power purposes.

English, Morse & Co., of Kansas City, Mo., dealers in machinery and engineering supplies, are giving special attention to complete power plants for electric light and power stations; Corliss and high speed engines are being sold for this work, and the company has recently put in some plant for the Edison electric light station at Kansas City. Sales of Worthington steam pumps and Lidgerwood hoisting engines are reported, and a large stock is kept of plant and supplies.

The Ball Engine Co., of Erie, Pa., has several orders for engines for operating electric street railways.

Rubber.—Rubber belting, and other rubber goods for manufacturing and household purposes, are manufactured by JOHN W. BUCKLEY, 156 South St., New York.

BRIDGES AND CANALS.

New York State Canals.—A considerable amount of work is to be done on the canals, and proposals will be received until July 30, by JAMES SHANAHAN, Superintendent of Public Works, Albany, N. Y. The following are the estimated quantities for lengthening the locks numbered 23, 24, 25, 26, 65, 66, Erie Canal, and 9 and 10, Oswego Canal: Eight bailing and draining; 18,000 cu. yds. earth excavation, 4,150 cu. yds. rock excavation, 1,555 cu. yds. excavation of old masonry; 19,250 cu. yds. embankment; 3,325 cu. yds. lining; 3,530 cu. yds. puddling; 200 cu. yds. slope wall and pavement; 415 cu. yds. loose stone filling; 621 cu. yds. vertical wall in cement; 1,805 cu. yds. vertical wall laid dry; 10,300 cu. yds. masonry in lock walls; 2,050 cu. yds. concrete masonry; 275 cu. yds. rubble cement masonry; 109,000 ft. B. M. white oak timber and plank; 76,000 ft. B. M. white pine timber and plank; 622,000 ft. B. M. hemlock timber and plank; 40,750 ft. B. M. white oak in gates and sills; 22,400 lin. ft. bearing piles (delivered); 22,000 lin. ft. bearing piles (driven); 2,640 lin. ft. fender piles (delivered); 2,400 lin. ft. fender piles (driven); 322 lin. ft. fender piles delivered and set; 595 lin. ft. snubbing posts set; 30,100 lbs. wrought iron; 2,080 lbs. cast iron; 22,800 lbs. spikes and nails; 400 lbs. lead cement; 8 sulphur and sand cement; 10 painting lock gates and railing; 32 composite valves and fixtures; 10 kerosene street lamps in place; 120 lin. ft. gas-pipe railing, including sockets, T's, etc.; 4 removing and replacing gates. Deduct materials furnished by the State: 450 cu. yds. face stone at $8; 560 cu. yds. of backing at $2.50; 235 cu. yds. of vertical wall stone at $1.75; 215 cu. yds. of slope wall stone at $1.25; 75 cu. yds. of loose stone at $.75. The following are the quantities for rebuilding Lock No. 12, Black river canal: 1 bailing and draining; 1,500 cu. yds. of all excavation except lock masonry; 1,300 cu. yds. excavation of lock masonry; 1,200 cu. yds. embankment; 220 cu. yds. lining; 450 cu. yds. puddling; 530 cu. yds. rubble masonry in chamber walls; 680 cu. yds. dressed face masonry; 20 cu. yds. concrete masonry; 4,500 ft. B. M. white oak timber, etc.; 3,500 ft. B. M. white pine timber, etc.; 6,000 ft. B. M. hemlock timber, etc.; 2,000 ft. B. M. replacing old timber; 40 lin. ft. snubbing posts set; 2,000 lbs. wrought iron; 100 lbs. cast iron; 1,200 lbs. spikes and nails; 50 lbs. lead cement; 1 sulphur and sand cement; 4 taking out and replacing gates. Deduct materials furnished by State, 500 cu. yds. of lock stone at $2.50; 300 lbs. wrought iron at 3 cts. per lb.; 100 lbs. cast iron at 2 cts. per lb.

Bridges.—*Fairhaven, Mass.*—Plans and specifications for the iron bridge over the Acushnet river have been prepared by GEO. A. BRIGGS, architect. It will be 450 ft. long, with 32-ft. roadway and two 6-ft. walks. There will be a draw.

Dalton, N. Y.—The Hawkins Bridge Co., of Springfield, is building a bridge over the river at Elm St., at a cost of $7,500.

Elizabeth, N. J.—The contracts for the Spencer St. drawbridge over the Elizabeth river have been let to E. S. Newberry, at $3,432 for masonry, and the King Iron Bridge & Mfg. Co., of Cleveland, O., at $3,390 for iron superstructure.

Pittsburg, Pa.—The Dravosburg Bridge Co. has let the contract for substructure to C. I. McDonald and W. C. Jutte, and for superstructure to the Keystone Bridge Co., of Pittsburg. President, JOHN M. RISHER; Vice-President, THOS. REYNOLDS; Secretary, W. J. E. MCLAIN; Engineer, WM. WEISKOP.

York, Pa.—The County Commissioners have authorized the issuing of a $125,000 flood loan, to erect and repair the bridges washed away or damaged by the recent flood.

Baltimore, Md.—The following proposals for bridge over the Patuxent river have been received by T. H. DISNEY, C. E.: H. G. Weitz & Co., Frederick, $7,325; Wrought Iron Bridge Co., of Canton, O., $6,800; Washington Architectural Iron & Bridge Co., of Washington, $4,971.70; Penn Bridge Co., $6,900 and $6,875; Pittsburg Bridge Co., $6,950; King Iron Bridge & Mfg. Co., of Cleveland, O., $6,400; Groton Bridge Co., $5,400.

Chattanooga, Tenn.—The Smith Bridge Co., of Toledo, O., has the contract for the superstructure of the Tennessee river bridge at $122,361.16, and Neeley, Smith & Co. have the contract for the substructure at $96,197.16. The County Court has authorized the issue of $300,000 in bonds to pay for the bridge.

Lancaster, Tenn.—A bridge 145 ft. long is to be built over South fork. For particulars address B. A. JAMES.

Augusta, Ga.—The contract for piers and abutments for a bridge over the Savannah river has been let to T. O. Brown at $11,347.

St. Augustine, Fla.—The St. Augustine & North Beach Ry. Co. has let the contract for a bridge 1,500 ft. long over the St. Sebastian river to Van Ebersten, Cooper & Co.

Florence, Ala.—The contract for the piers of the Tennessee river bridge of the Memphis & Charleston Ry. has been let to Barron, Peace & Garden, of Marseilles, Ill.

Cincinnati, O.—The following proposals have been received by H. J. STANLEY, City Engineer, for the Browne St. bridge over the Miami canal: King Iron Bridge & Mfg. Co., Cleveland, O., $5,230; Queen City Bridge Co., Cincinnati, $5,243; Milwaukee Bridge Co., $5,550; F. P. Brackett Bridge Co., Cincinnati, $5,800; Columbus Bridge Co., $6,000; Variety Iron Works, Cleveland, $6,001.50.

Caledonia, Dak.—The following proposals have been received by H. A. LANGLIE, County Auditor: A. V.

Bayne & Co., Minneapolis, Minn.: 1 iron bridge, $1,760; 1 pile and 2 combination bridges, $3,058; Pittsburg Bridge Co., for 4 bridges, $2,500; King Iron Bridge & Mfg. Co., Cleveland, O., $2,859; Missouri Valley Bridge & Iron Works, Leavenworth, Kan., $2,440, with iron bridge on piles, or $3,300 on iron tubular piers; Smith Bridge Co., Toledo, O., $2,487; Penn Bridge Co., Beaver Falls, Pa., $2,650; Wrought Iron Bridge Co., Canton, O., $2,480, or $2,510 for 3 iron span and pile bridges; Minneapolis Bridge Co., Minneapolis, Minn., $2,575; George E. King Bridge Co., Des Moines, Ia., $2,270; Geo. Cooper, Belmont, Dak., $305 for wooden bridge 56 ft. long with 24-ft. span; S. C. Lautermann, Hillsboro, Dak., $1,635 for 2 combination and 1 pile bridge. The contract was awarded to the Wrought Iron Bridge Co., at $2,510.

Williamsport, Dak.—A bridge contract has been awarded by E. T. HERRICK, County Clerk, to A. Y. Bayne & Co., of Minneapolis, Minn., at $3,000. The other bid was from the Pittsburg Bridge Co. (J. C. Turck) at $3,300.

Stayton, Ore.—Hoffman & Bates, of Portland, Ore. have been awarded the contract for a bridge over the Santiam, at $18,250.

El Paso, Tex.—The international bridge over the Rio Grande has been opened for traffic. A street railway runs across the bridge.

Fort Worth, Tex.—The Missouri, Kansas & Texas Ry. Co. will rebuild its bridge over the Trinity river, to replace one recently destroyed by a flood.

Chicoutmi, Que.—The new iron bridge, 400 ft. long, has been opened to traffic.

The Delaware & Hudson Canal Co. will replace 18 wooden bridges on the Adirondack Ry. with iron structures.

The Anniston & Montgomery Ry. Co. has awarded the contract for an iron bridge 725 ft. long over the Tallapoosa river to the Atlantic Bridge Co., of Atlanta, Ga.

Riveted Lattice Bridges.—The Chicago & Eastern Illinois Ry. Co. is having 3 riveted lattice through bridges built in Iroquois Co., Ill.: 135-ft. span over the Iroquois river near Watseka, 145-ft. span over Sugar creek near Woodland, and 150-ft. span over Sugar creek near Watseka. Clear height, 20 ft; 14 ft. clear roadway. They are built by the Lassig Bridge Works, of Chicago, and Mr. A. B. CARSON is in charge of the work. Another bridge of the same type will be built over the Little Vermillion near Newport, Ind. The foundations are of wooden piles, 12 at each corner of the bridges. This kind of foundation was adopted in order to make the work as cheap as possible, as a great many of the Howe truss bridges on the line will be replaced this year with new structures. S. H. MILLER, of Danville, Ill., is Chief Engineer.

ELECTRICAL.

Electric Light.—***Dixfield, Me.***—The Dixfield Electric Light Co. is putting in a Heisler plant with a capacity for 4,800 c. p. The lights will be used for offices and domestic service.

Springfield, Mass.—The United Electric Light Co. has put up 55 of the 350 double-carbon lights that the contract calls for; they are on the Thomson-Houston patent.

New York, N. Y.—The Gas Commission has awarded contracts to the United States Co. at from 25 to 35 cts. a lamp, to the Brush Co. at from 35 to 45 cts. a lamp, to the East River Co. at 35 cts. a lamp, and to the Mount Morris Co. at from 24 to 25 cts. In all, 889 lamps were contracted for and 511 more are needed.

Brooklyn, N. Y.—The Bedford Electric Power & Light Co. has been incorporated by H. E. OAKLEY, WM. A. AINSWORTH, J. H. MASON, VANDEWATER SMITH, and HENRY LOTZ. Capital stock, $50,000.

Lansingburg, N. Y.—The following proposals have been received: Troy Citizens' Gas-Light Co., 100 2,000 c. p. arc lights, to burn all night, every night, $120 a light, or 100 1,200 c. p. lights at $90 a light; Mutual Electric Mfg. Co., of Brooklyn, 100 2,000 c. p. arc lights for $7,999, and $79.99 for each additional light, the company reserving the privilege of furnishing incandescent lights for commercial purposes; Union Electric Light & Power Co., 100 arc lights for $8,900, the company agreeing to place one arc light in front of Fireman's hall and one additional light for each 30 commercial arc lights; or 25 c. p. incandescent lights at $18 a year. The company stated that 320 lights would be sufficient for lighting the village.

Allegheny, Pa.—The Gas Committee has presented plans and specifications for the purchase of a plant having a capacity of 450 arc and 3,000 incandescent lights. The plan is to have bids on such a plant, and, after it has been in successful operation for 6 months, the city is to purchase it. The report specifies 160 mast-arms at an elevation of 40 ft. above the ground, and 52 pedestal towers, 125 and 150 ft. high, each containing 5 lights, and each tower to be provided with an elevator. The report also specifies the lighting of all public buildings. It is further required that the plant be completed in 4 months. The minority report of the committee favored the lighting of the city by contract for five years, with the privilege of purchasing the plant at the end of that time.

Mauch Chunk, Pa.—The Heat, Power & Electric Light Co. has adopted the Westinghouse system.

Bellaire, W. Va.—The Bellaire Electric Co. has made a contract for plant with the Thomson-Houston Co. There will be an 80 H. P. engine, furnished by the Ball Mfg. Co. of Erie, Pa.

Goshen, Ind.—The city has adopted a tower system of electric lighting; there will be 25 lights of 1,000 c. p.

Peoria, Ill.—The Merchants' Light & Power Co. has been incorporated by P. E. SINGER, JOHN BIRKS, and K. C. PARDEE. Capital stock, $35,000.

Burlington, Wis.—The Burlington Edison Electric Co. has been incorporated by LEONARD J. SMITH, HERBERT WAGNER, Jr., and B. BREHM. Capital stock, $15,000

Ottawa, Kan.—C. T. EWING, owner of the waterworks, will put in an electric light plant and has purchased the engine and dynamos.

London, Ont.—The Hamilton Electric Light Co. has agreed to furnish 230 to 250 arc lights for the city, the same as in use at present, being of 45 volts and 10 amperes, nominally 2,000 c. p. at 28 cts. each per night for every night in the year from dark to daylight, for 5 years. Also as many incandescent lights of 30 c. p. each as may be required, at $25 each per year, to be lighted from dark to daylight, for 5 years. All additional lights to be at the same rate.

SEWERAGE AND MUNICIPAL.

Drainage.—***Illinois.***—The South Middleport and Sheldon Drainage District (Townships 26 & 27, North Range 11 West of the 2d P. M., Iroquois Co., Ill.) was organized in 1880. About 30 miles of open drains were made with ditching machines and plows and scrapers, without surveys. These ditches are all too small, are badly graded, and do not furnish sufficient outlets for tile drainage. The original district contained over 20,000 acres, and steps are now being taken to add about 5,000 acres and have the ditches dredged out and extended in order to thoroughly drain the entire district. Contracts for dredging will probably be let during the month of August. The commissioners are JAS. RUSSELL, JOHN FLEMING, Jr., and WARREN EWING, of Sheldon, Ill. The Engineer and Superintendent is JACOB A. HARMAN, of Watseka, Ill.

Water-Power.—***Depere, Wis.***—A Detroit syndicate has purchased the rights of the Depere Water Power Co. for about $100,000; the dam will be raised to enlarge the reservoir and increase the power.

Winnipeg, Man.—Mr. J. T. FANNING, M. Am. Soc. C. E., of Minneapolis, has presented his report on the utilization of the Assiniboine river for power purposes. The bottom of the river will give a good foundation for the dam, which will be 600 ft. long, of filled crib work; the canal will be 1,500 ft. long and about 10 ft. deep. The total cost of the work, including dam, masonry, gates, canal, bridges, grading, contingencies and superintendence, is $399,860.

Sewers.—***Brooklyn, N. Y.***—The State Board of Health has approved Mr. VAN BUREN'S plan for a sewer system in the 26th Ward. The main sewer will be 15 ft. diameter. The sewage will be conveyed into deposit tanks, to be located on the marshes near the bay. A part will there be disinfected and disposed of for fertilizing purposes, and the balance will be pumped out into the bay. It is estimated that the sewer work complete will cost about $1,000,000.

White Plains, N. Y.—Proposals for sewers and sewage disposal will be received by the Village Clerk on July 22. The plans have been prepared by WM. B. LANDRETH, C. E., of Schenectady.

Montclair, N. J.—The Township Committee has appointed a subcommittee to obtain plans and specifications for a sewerage system.

Sandford, Fla.—The city has appropriated $33,000 for sewers.

Carlinville, Ill.—Mr. F. WM. RAEDER, C. E., of St. Louis, Mo., informs us that surveys for a sewerage system will be made soon.

West Burlington, Ia.—A sewage system is being contemplated.

Fort Russell, Wyo.—The Secretary of War has authorized the expenditure of $25,000 for sewers at this post.

Santa Monica, Cal.—The city has protested against the location of the outfall sewer of Los Angeles, which is within a few thousand feet of the city limits, and it is feared that the sewage will accumulate on the beach. The outlet is to be located a mile further away.

Hastings, Neb.—Mr. ANDREW ROSEWATER, C. E., of Omaha, is interested in the proposed system of sewers.

Houston, Tex.—Mr. W. H. KIERSTED, C. E., of Kansas City, Mo., will prepare plans for the proposed sewerage system.

Sewage Disposal.—The Sanitary Engineering & Supply Co. has been organized in Toronto, Ont., and proposes by means of patent appliances to convert sewage, house refuse and garbage into a marketable manure, the effluent water to be discharged in a perfectly clear and bright state. The system can be applied to public and private institutions which require local treatment.

WATER-WORKS.

New England States.

Newport, N. H.—A company is to furnish a water supply. Water will be taken from Long pond in Croyden, or Gilman pond in Unity.

Hinsdale, Mass.—Dwyer Bros. contractors for the dam, now have a large force at work and expect to complete it in about 90 days.

Marlboro, Mass.—About 1¼ miles of extensions will be made.

Pittsfield, Mass.—A new and larger main is to be laid to the Jubilee hill section.

Springfield, Mass.—A member of the Water Board says the question of a pure water supply has resolved itself into three questions: Whether the present reservoir shall be emptied, cleaned and refilled, the water filtered before reaching the city, or the present source of supply abandoned for drinking purposes altogether. The first scheme is considered most feasible, and the Water Board is preparing specifications of the cost of the auxiliary supply. The commissioners question the power of filtration to remove impurities in solution as well as in suspension, and to build a new system throughout they consider as too expensive. A joint committee has been appointed to consider Alderman MCFETHERIE'S plan, to secure a supply for domestic use only, by concentrating the water of several brooks into a reservoir at Bircham's bend in Chicopee, three miles from town. Power from the Chicopee river would be used to pump the spring water. Estimated cost, $368,000.

Lincoln, North Smithfield and Cumberland, R. I.—The city of Woonsocket has been granted power by its common council to lay water pipes into these towns.

Stamford, Conn.—B. H. HULL, State Engineer, has examined the dam and reservoirs of the Stamford Water Co., and found the former in a leaky condition. It will be repaired at once and raised four or five feet under his supervision.

Portland, Conn.—O. GILDERSLEEVE, President of the Portland Water Co., sends us the following:

A gravity system of water-works will be built by the Portland Water Co. $70,000 of bonds and $100,000 of stock have been issued. Water will be taken from Buck brook and used for fire and domestic purposes. Contractors, Wheeler & Parks, Boston, Mass. Engineer, FRANK C. KIMBALL. Work was begun June 1 and will be completed Nov. 1. Population, 4,500.

South Norwalk, Conn.—A committee of citizens is examining the different methods of filtering water from reservoirs.

Middle States.

New York, N. Y.—The contract for clearing the site of Reservoir A, on the Muscoot branch of the Croton river, and building a retaining dam across the stream, has been awarded by Public Works Commissioner GILROY to John McQuade, at $540,610. There were ten other bids, the lowest being that of Frederick Thielman, $555,934, and the highest that of J. McNamee, $1,062,360. Chief Engineer BIRDSALL'S estimate of the work was $654,890. The reservoir, as originally planned in 1857, has an area of 485 acres, a capacity of 5,300,000 gals., and drained a surface area of 21 sq. miles. The dam proper will be 64 ft. high and 1,500 ft. long.

Amsterdam, N. Y.—The Galway reservoir has been examined by the superintendent and pronounced in good condition.

Olean, N. Y.—A contract for extending the water mains on seven streets has been awarded to Solomon Curtis.

Rochester, N. Y.—State Engineer JOHN BOGART, with a corps of engineers, is to make a detailed examination of the proposed water storage plan as a means of furnishing water to this city, and will present his report to the next Legislature.

Brockport, N. Y.—The following resolutions have been passed by the village board:

Resolved: That whoever receives the franchise for putting in the system of water-works in this village shall comply in the main with the Albion contract, and the trustees of village shall say where hydrants shall be placed.

Resolved: That no system shall be contemplated, except a thorough and first-class one.

Otego, N. Y.—Work will be begun soon. President of the water company, W. H. PARKER.

Ogdensburg, N. Y.—A. H. LORD, Superintendent, informs us that the extensions contemplated are: 6,000 ft. of 6 and 4-in. cast-iron pipe, 7 hydrants and 9 gates. Mathews hydrants, from R. D. Wood & Co., Philadelphia, are used.

Buffalo, N. Y.—The city is offering $100,000 of 7 per cent water bonds for sale.

Cohoes, N. Y.—A new 6-in. main is being laid in Younglove Ave.

Westfield, N. Y.—A. E. PIERCE, Secretary, informs us that a contract has been let for works to be owned by the town, to Clarence Delafield, New York. Estimated cost, $60,000. The town now has a small system for fire protection only.

College Point, N. Y.—The townsmen are talking of laying 6,000 ft. of 8-in. pipe and setting 10 or 12 Mathews hydrants.

Jersey City, N. J.—The Board of Finance has an

Lake View, Ill.—The following bids for building a water supply tunnel have been received by H. C. LEACH, City Engineer. CHARLES WESTERN is the engineer in charge of the tunnel work. The address of all bidders is Chicago, Ill., except Joseph J. Duffy & Co., and T. D. Murphy, of Lake View, and Lydon & Hopkins, of Pullman, Ill. The contract was awarded to Schailer & Schniglau.

BIDDERS.	For 5-ft. Tunnel Complete. 5,000 ft.	For 6-ft. Tunnel Complete. 5,000 ft.	For Tunnel, 5-ft. diam. per lin. ft.	For Tunnel, 6-ft. diam. per lin. ft.	Shore Shaft, per lin. ft.	Lake Shaft, per lin. ft.	Lake Crib.	Lighthouse.	Electric plant and lights.
Wright, Meysenburg & Sinclair	$100,400	$170,240	$17.75	$18.50	$40.00	$142	$59,000.00	$4,500	$1,500
Fitz Simmons & Connell	.....	.....	23.00	25.00	50.00	125	64,000.00	4,000	
J. C. Robinson	219,900	235,900	16.45	19.65	65.00	300	122,000.00	.....	
Shailer & Schniglau	156,650	159,650	15.85	16.85	49.75	144	72,975.00	4,200	1,200
Geo. Messersmith	.....	.....	19.75	21.25	47.00	....	.....	.....	2,700
Jos. J. Duffy & Co.	.....	.....	16.95	16.95	49.00	....	.....	.....	
T. D. Murphy	.....	.....	18.25	19.00	43.00	....	.....	.....	2,500
McAdam & Amberg	.....	.....	16.32	18.20	125.00	500	73,615.80	.....	
Hiero B. Herr & Co.	150,000	174,000	13 90	16.90	48.00	150	69,000.00	5,000	4,000
Lydon & Hopkins	.....	.....	16.00	17.50	50.00	80	71,000.00	.....	
						225			

nounced a reduction of $502,000 in the city's debt by redeeming $402,000 of Bergen and Hudson Cities' improvement, water, and public school bonds, which mature this month.

Lancaster, Pa.—An artesian well 1,600 ft. deep is still passing through limestone without any indications of water.

Allegheny City, Pa.—The ordinance awarding the contract for laying 11 miles of mains was defeated June 13, and no contract has since been awarded. Complaints are being made by the citizens of the nuisance created by the pipe already delivered being left in the gutters.

Irwin, Pa.—The following is from MURRAY FORBES, Greensburg, Pa., Secretary of the Westmoreland Water Co.:

A gravity system of water-works, via the Westmoreland Water Co's. system, is to be constructed by the Irwin Water Co. Work will begin about August 1 and be completed December 1. A 2,500,000-gall. reservoir will be constructed. There will be about 5 miles of wrought-iron and cement mains. Services, lead. Hydrants Ludlow, 25. Hydrant rental, $50 each per annum. President, F. Z. SHELLENBERG, Secretary, MURRAY FORBES; Treasurer, J. D. BROWN; Engineer, C. W. KNIGHT; Contractors, American Pipe Mfg. Co., Philadelphia, Pa. Population, est., 5,000.

Catonsville, Md.—J. M. CONE, President, informs us that a 485,000-gall. stand-pipe and 2 miles of 8-in. mains will be added this year.

South Atlantic an South Central States.

Radford, Va.—All communication regarding the Radford Land Co. (mentioned in last week's issue) should be addressed to HOWARD MURPHY, Engineer Radford Land Co., Philadelphia, Pa. Mr. MURPHY has made the preliminary surveys and re, ort and been engaged to build the works.

Hampton, Va.—C. T. HOL ZCLAW, President of the Hampton Water Co., has sent s the following:

It is expected that the water-works will be put in operation July 18. The works have a daily pumping capacity of 4,000,000. There are 3¼ miles of mains. Daily consumption, est., 1,000,000 galls. Cost of works, $60,000. President, C. T. HOLTZCLAW. Treasurer, J. A. WATKINS. Secretary, H. R. BOOKER.

Lincolnton, N. C.—A system of water-works will probably be built. Address the Mayor.

Charleston, S. C.—The Uptown and George St. reservoirs have been connected by a large cast-iron main. This will give the company an increased water supply, and enable them to utilize the water now flowing from the artesian well which they are sinking.

Fort Valley, Ga.—It is said works will be built at once. Address F. C. HOUSER.

Macon, Ga.—The city council will introduce a bill in the Legislature this month authorizing the issue of $100,000 of bonds for water-works. The five years' contract of the Macon Gas & Water Co. will expire in 1892. City Clerk, B. SMITH.

Atlanta, Ga.—The rapid increase in population is rendering the supply inadequate, and the city authorities are investigating the question of additional supply. The Atlanta Manufacturers' Association state that the Chattahoochee river is the only source from which a supply sufficient for all time can be obtained.

Washington, Ga.—The following information is given us by T. BURWELL GREEN:

It is proposed to issue $25,000 or $30,000 of bonds and build water-works. The supply to be taken from springs and pumped to a stand-pipe. Contracts are expected to be let in September.

Jacksonville, Fla.—Additional mains will be laid.

Madison, Fla.—Address W. S. JORDAN, Secretary of the Madison Water Co., for quantity of pipe and hydrants, and capacity of boiler, pumps, tanks, etc., he will require in building water-works.

Citra, Fla.—A. S. KELLS will lay 8,000 ft. of pipe for irrigating in the fall.

Sheffield, Ala.—The Sheffield Water Co., W. L. CHAMBERS, President, invites proposals for the construction of water-works until July 20. Proposals will be received for the whole work or parts.

Bessemer, Ala.—It is reported that a Western syndicate is endeavoring to purchase the works.

New Decatur, Ala.—A. H. Howland, of the firm of Howland & Ellis, Boston, Mass., contractors for the city water-works, now nearly completed, is perfecting arrangements for the further extension of the water system of the two cities.

Biloxi, Miss.—Work has been begun recently on the artesian well donated to the town by Mayor H. T. HOWARD. It will be in the centre of an ornamental circle, and be called Howard circle in honor of the donor. Another well will be put down by T. J. Montrose, on Ship island, for a new hotel.

Florence, Ala.—WM. H. BRUNDIGE has sent the following:

The final contract between the city and the Jeter & Boardman Water & Gas Co., Macon, Ga., was signed July 13. Construction will be begun within 60 days, and the works will be completed by Oct. 1, 1890. Mr. BRUNDIGE will be both Superintendent of construction and of the completed works. The company will also do sanitary plumbing. Probably the new company will buy the plant and rights of the Cypress Water-Works Co., which operates a small system.

Vicksburg, Miss.—The water company has begun setting up its auxiliary 1,000,000-gall. pump. This will guarantee a sufficient supply of water for all purposes.

Shreveport, La.—Four 10-ft. Hyatt filters with a daily capacity of 1,500,000 galls. will be added before Oct. 30.

Chattanooga, Tenn.—The Camden Hill & Hotel Park Street Ry. Co., has awarded the contract for a water-works stand-pipe to Armstrong Bros., Springfield, O.

Newport, Ky.—The Laidlaw & Dunn Co., Cincinnati, O., has received the contract for the entire pumping plant. This plant is located at the new reservoir of the Covington water-works.

Stanford, Ky.—Water-works are expected to be built in the fall, with a capacity to supply water for 20,000 people. Address WILLIAM WELSH or D. W. VANDERVER.

Richmond, Ky.—The City Council has accepted and agreed to pay for the charter of the Richmond Water-Works Co. A committee has been appointed to visit different water-works in Kentucky, and upon their return they will submit a proposition to the voters. Bids will then be wanted. Address Hon. W. B. SMITH.

Troy, Ala.—The Jeter & Boardman Water & Gas Association, Macon, Ga., are negotiating for a contract to build water-works.

Georgetown, Ky.—The Laidlaw & Dunn Co., Cincinnati, O., has sold two 1,000,000-gall. standard duplex steam pumps to the water-works.

Winchester, Ky.—A vote will soon be taken on the question of building water-works.

North Central States.

Hillsboro, O.—The City Council has appointed a committee to receive proposals for water-works.

Marysville, O.—H. D. RICHARDS, representing Ferris & Halladay, Jersey City, N. J., has made a proposition to build works.

Terre Haute, Ind.—The new water-works company have begun their contemplated extensive improvements. New engines and pumps will be placed in a new engine house and filters will be added. No mains will be smaller than 6 ins. The new pumping machinery will have a daily capacity of 16,000,000 galls. The company has mortgaged the old plant for $1,000,000 to DEMAS DEMING, Chicago. This amount is to be issued in 6 per cent. bonds, payable semi-annually; $440,000 will be issued at once; $110,000 of the remainder will be applied to redeem the outstanding bonds, and the remainder placed on deposit for making extensions and improvements.

New Albany, Ind.—A small amount of new mains will be laid, and four new hydrants set.

Greensburg, Ind.—The Pond Engineering Co., St. Louis, Mo., is to furnish the water company with two 75 H. P. boilers, complete.

Owosso, Mich.—The contract for water-works, to be completed in October, has been awarded.

Marshall, Mich.—The engine house is completed and the well is proving successful. It is expected the new works will soon be put in operation.

Monroe, Mich.—Works are to be built at once. Estimated cost, $120,000. Gen. GEO. SPALDING is President of the water company.

Grand Rapids, Mich.—A new 2,500,000-gall. pump is being added.

Ypsilanti, Mich.—The Porter Mfg. Co., of Syracuse, N. Y., has been awarded the contract for furnishing a 150,000-gall. stand-pipe.

Dowagic, Mich.—Spitzen & Co., Toledo, O. have purchased $40,000 of 5 per cent. water bonds at $757 premium.

Avondale, Ill.—A petition is being circulated asking the City Council to lay water pipes along Railroad avenue to supply Avondale, Grand View, and Irving Park with water.

Peoria, Ill.—The water company propose boring through the bed of the Illinois river in search of a stratum of water under the river from which to draw their supply. The second well has demonstrated that it will yield 5,000,000 galls.

Belleville, Ill.—The city is willing to pay only $50 per hydrant instead of $65 as heretofore, which proposition the company has refused to accept.

Taylorville, Ill.—The city has contracted with the Pond Engineering Co., St. Louis, Mo., for a 750,000-gall. Gaskill non-compound pumping engine.

Wauwatosa, Wis.—The Wauwatosa Water Co. has been incorporated by G. H. WOLCOTT, G. W. RENGOSE and E. E. WARNER. Capital stock, $24,000.

Northwestern States

New Hampton, Ia.—The water-works project has been defeated.

North Des Moines, Ia.—The City Council has passed resolutions repealing the power and privilege granted the North Des Moines Water Co., to construct, maintain and operate water-works to supply the town and citizens, stating as their reason that the "company has practically abandoned its undertakings and failed in the performance of its duties and obligations." The town will vote on the question of issuing bonds for water-works July 20.

Neola, Ia.—A pump, boiler and pump-house are projected.

Council Bluff, Ia.—A 2-in. main is being laid in the park to convey water to the fountains, to be built, as well as to supply the drinking fountain.

Davenport, Ia.—We are indebted to JAS. P. DONOHUE, Secretary, for the following:

At a recent meeting the City Council by unanimous consent granted the Davenport Water Co. a new charter to provide for the supply of water for domestic use and fire protection and to amend an ordinance covering the same matter passed and approved Dec. 4, 1872. The new ordinance offers an inducement to the company and enables it to make certain extensions of mains. The grant is for 25 years, with privilege of city to buy at end of 25 years; but should the city fail to buy at that time, the franchise is extended without notice for a period of 25 years longer, and at the end of 50 years the company shall have same right as all others. The water company is exempt from taxes in consideration of supplying city buildings. City pays for all water used for flushing sewers, street sprinkling and for all watering troughs (except 4, which are free) at the rate of 10 cts. per 1,000 galls. The company is now laying 5 miles of 12, 8, and 6-in. pipe, and 60 new hydrants are to be placed. The pipe is from Shickle, Harrison & Howard, and the gates and hydrants are Ludlow. Several more miles of extensions are in contemplation. Population, about 35,000. The company has about 33 miles of pipe, 330 hydrants, and 1,710 consumers, many of the latter being large factories. The city pays $40 per hydrant per year.

West Burlington, Ia.—WM. W. CLARK, Recorder, informs us that ½ mile of 6-in. pipe, and 8 hydrants will be added.

Cherokee, Ia.—We are indebted to W. W. CURTIS, St. Paul, Minn., for the following:

The construction of water-works to be owned by the city was begun June 1 and will be completed about Aug. 15. E. T. Sykes & Co., Minneapolis, Minn., are the contractors. Engineer W. W. CURTIS, St. Paul, Minn. Water will be pumped from artesian wells to an 18 by 80 ft. stand-pipe, for domestic use, and connection can be made with the river, should supply from wells proved inadequate, in case of fire. The pumping machinery is from the Barr Pumping Engine Co., Philadelphia, Pa. Pipe and specials are from the South St. Louis (Mo.) Foundry and the stand-pipe from Tippett & Wood, Phillipsburg, N. J. Hydrants, Mathews, 17. Mains, c. i. 2¼ miles. Pressure: Ordinary, 60 to 80 lbs. Fire, 150 lbs. Cost, $25,000. Bonded debt, $20,000. Interest, 5 per cent.

Moorhead, Minn.—An artesian well is being sunk.

Rochester, Minn.—The daily consumption of water is now estimated to be 150,000 galls. There are about 300 consumers, a large number of whom are supplied through meters, and this method is growing in favor in the city. The supply is ample and quality continues good.

Anoka, Minn.—At a special meeting of the City Council an ordinance was passed which places the works in the hands of E. T. Sykes & Co., Minneapolis, Minn. The system is to be in operation by Jan. 1, 1890.

Winfield, Kan.—We are indebted to the Secretary, J. H. DECKER, Salina, Kan., for the following:

A 1,000,000-gall. Oliphant filter is being erected. A new inlet crib, higher up, has been proposed for early construction, together with 1,350 ft. of 18-in. wood conduit,

Marysville, Kan.—A recent vote for water-works gave a majority of over 100 in favor of issuing bonds.

Wellington, Kan.—CHARLES PERRY, Jr., President of the water company, sends us the following:

These works were sold under foreclosure March 4, 1889, and the former bondholders became the stockholders. They were bonded for $100,000. Extensive improvements are being made. A new 1,000,000-gall. Worthington pump, a filtering plant, about three miles of mains, a new dam and stand-pipe will be added at an estimated cost of $45,000.

Lexington, Neb.—This town wants water-works.

Omaha, Neb.—The Water Co. will begin the construction of a stone-lined reservoir of 15,000,000 galls. capacity about Aug. 1.

Stanton, Neb.—The town has voted $12,000 of water bonds.

Geneva, Neb.—The question of building water-works is being agitated. The town is destitute of fire protection.

Madison, Neb.—The water-works were officially tested, July 4.

Fremont, Neb.—The council has sold $110,000 of bonds for water-works and other improvements to the Fidelity Trust Co., Kansas City, Mo., at par, accrued interest and $600. A contract has since been made at the Omaha office of the Pond Engineering Co., St. Louis, Mo., for a complete reconstruction of the works into the Holly system, including a 1,500,000-gall. compound condensing Gaskill pump, with boilers, and laying of all mains, furnishing hydrants, valves, etc. A system of driven wells, 70 ft. deep, will be put in by the Cook Well Co., St. Louis, Mo.

Tekamah, Neb.—An effort is being made to secure water-works and the question of bonding will probably be decided July 19.

Lincoln, Neb.—A committee consisting of Mayor GRAHAM and others has been appointed to reclaim the old well at the city park. At a citizens' mass meeeting a committee, consisting of A. J. SAWYER, O. P. MASON and others, was appointed to discuss the water supply question in general.

Nebraska City, Neb.—E. A. RUDIGER, Superintendent, has sent the following:

Another basin, or reservoir, and a change in the pumping system, have been projected. The City Water Co. owns the works, and also an electric light plant, to which it thinks of adding an incandescent system.

Hastings, Neb.—The daily consumption is now 700,000 galls.

Wymore, Neb.—Water-works are soon to be erected and controlled by the city.

Harrison, Neb.—C. F. CARLETON has given us the following:

The city proposes to build water-works by issuing bonds. Water will be pumped to a tank and used for fire and domestic purposes. E. D. SUTTERLEE can give information. Population, 300.

Grant, Neb.—We are indebted to BEN. S. CLARKE, Ashland, Neb., for the following:

The Lincoln Land Co. are building the water-works at this place and have awarded the contract for pipe and specials and a 96,000-gall. stand-pipe to W. J. Cooper & Cole Bros., Chicago, Ill. Trenching and pipe-laying, BEN. S. CLARKE, Ashland, Neb. Supply will be from wells. Designing Engineer, C. H. MEEKER. Constructing Engineer, BEN. S. CLARKE. Mains, cast-iron. Meters, 15. Hydrants, Eclipse. Valves, Arthur. Cost of works, $15,000. Interest on debt, 6 per cent. Hydrant rental, $60 per annum. Work was begun June 26, and will be completed Sept. 15. Population, 500.

Elk Point, Neb.—Water-works are being discussed. An artesian well will be sunk at once.

Huron and Redfield, Dak.—The question of sinking artesian wells in this vicinity for irrigation in general, is being vigorously put forth. A committee has been appointed to meet the Senate Committee on irrigation next fall. F. F. B. COFFIN and A. W. BURTT, Huron, Dak., have been appointed.

Groton, Dak.—Bids for sinking an artesian well were received by W. B. MILLER, Auditor, on July 10.

Fort D. A. Russell, Wyo. Ter.—C. F. HUMPHREY, Captain and Asst. Quartermaster, U. S. A., Cheyenne, Wy., sends us the following:

The intention is to increase the present water supply at Fort D. A. Russell, a military post three miles from Cheyenne. The present plant is inadequate. Plans have been prepared and are now under consideration by the military authorities.

Southwestern States.

Fort Smith, Ark.—The water company will lay about 14 miles of additional mains.

Little Rock, Ark.—The entire plant has been purchased from ZEB WARD by W. S. KUHN for the American Water-Works & Guarantee Co., L't'd, Pittsburg, Pa., at $400,000. The plant is new and the franchise runs for 49 years.

Taylor, Tex.—A stand-pipe 102 ft. high is being built.

San Angelo, Tex.—J. L. MILLSPAUGH, President, informs us that they are contemplating an enlargement of the works the coming fall and winter.

Georgetown, Tex.—W. J. THOMAS, President, informs us they will lay 3 miles of 1½ in. and 1¼ miles of 1 and ¾-in. pipe, set 50 hydrants, 25 valves, and 20 meters. Also that 1,000 ft. of large pipe may be laid.

Bryan, Tex.—Bids for water-works will be received until July 22 by A. B. CARR.

Galveston, Tex.—The *News* states that insurance rates have been reduced 25 per cent. since the new water-works have proved successful.

Fort Worth, Tex.—The Fort Worth Artesian Water Supply & Street Sprinkling Co. has been incorporated. Capital stock, $5,000.

Laredo, Tex.—The water company contemplates extending their mains.

Weatherford, Tex.—Water-works are projected. Address the Mayor.

Wichita Falls, Tex.—Bell & Sloan will sink a 1,500-ft. artesian well.

Houston, Tex.—C. H. STRONG, Superintendent, sends the following:

A storage tank, 20 x 100 ft., will be built to receive the discharge from the flowing wells. The wells now have a daily flow of 1,750,000 galls., and an 8-in. well is now being sunk.

Trinidad, Colo.—The Water-Works Company has secured an order from Judge GUNTER instructing the city clerk to publish the ordinance granting a 30 years' franchise, which the mayor had refused to sign, on the ground that the rates fixed in the ordinance were exorbitant.

Las Animas, Colo.—The water-works were satisfactorily tested June 27.

South Denver, Colo.—The Citizens' Water Co. has petitioned the council for privilege to take water from the Platte cañon, build an underground water main not exceeding 4 ft. in diameter through Broadway from the north to the south boundary of the town and supply the town with water.

Greeley, Colo.—We are informed by E. F. DAWLEY, Superintendent, that a stand-pipe 30 ft. in diameter and 30 ft. high is to be erected.

Sterling, Colo.—All proposals for drilling the well have been rejected. The trustees have decided not to build the well at present.

Holyoke, Colo.—The following is from BEN. S. CLARKE, Ashland, Neb:

The construction of water-works was begun June 17, under the direction of Lincoln Town Site Co., with BEN. S. CLARKE as contractor. They will be completed October 15. They supply will be taken from wells. Designing Engineer, C. H. MEKEER. Constructing Engineer, BEN. S. CLARKE. Contractors for pipe and specials, and a 10 by 100 ft. stand-pipe, W. J. Cooner & Cole Bros., Lincoln, Neb. Hydrants, Eclipse, 15. Valves, Arthur. Mains, cast-iron, 5 miles. Cost, $30,000. Interest on debt, 6 per cent. Hydrant rental $60, per year. Population, 1,200.

Del Norte, Colo.—Water-works are to be constructed for fire and domestic use. President, T. C. HENRY, Denver. Address, A. F. MIDDAUGH, chairman, Engineer, GEO. WICKEL. The supply will be taken from the Rio Grande river, 14 miles above Tower ditch. Population, 1,000.

Silver City, N. M.—L. C. MUNGER, Engineer, informs us that the tunnel from which the water supply is drawn is being extended 200 ft. and that 9,000 ft. of 4-in. mains are being laid.

Pacific States.

Seattle, Wh. T.—A majority vote of 1,824 for building a new system of water-works has been taken. The estimated cost is $1,000,000.

Spokane Falls, W. T.—The city now has a daily water supply of 9,000,000 galls.

Sprague, Wash. Ter.—W. B. LOTTMAN, Secretary has sent us the following:

The Sprague Water Co. has a 25 years' franchise and will build works at an estimated cost of $15,000 to $18,000. GEO. S. BROOKS, President. Water will be pumped from a well to a 120,000 gall. reservoir. No contracts have been made. The company has a capital stock of $25,000 and has issued $25,000 of bonds.

Baker City, Ore.—At a special election to vote on the proposition to bond the city for $43,000, for extending the water system and the construction of city sewerage, the vote stood 152 in favor and 14 against the proposition.

Tulare, Cal.—The following is from D. W. MADDEN, President:

About 3 miles of additional mains are projected for the coming year. Two wells, 500 ft. deep, have recently been sunk, and a Buffalo compound duplex pump of about 1,500,000 galls. capacity, and a 50 H. P. boiler, added.

Hayward, Cal.—The following is from W. KNOX, owner of the water-works:

A well 25 ft. in diameter and 55 ft. deep, with tunnel 100 ft. long extending from its bottom, is now in progress. Two 500,000-gall. Dow pumps will be added at once. An extension of about 2,500 ft. of 4-in. pipe is thought of.

Nevada City, Cal.—A vote will be taken July 22 to decide whether the city shall issue $30,000 of bonds to buy the existing works from the company or build a new system.

San Diego, Cal.—The articles of incorporation of the San Diego Water Co. provide that the capital stock shall be $1,000,000. J. H. BARBOUR, G. PUTERBAUGH, W. W. WHITNEY, W. H. CLARKE, and E. W. BRITT have each subscribed $2,500.

Riverside, Cal.—The distribution mains will be extended this year.

San Pablo, Cal.—The San Pablo Water Co. has been incorporated for the purpose of supplying water for Oakland, Alameda, and other towns in Alameda county. Capital stock, $1,500,000. Principal office, San Francisco. Directors: HENRY MOLINEAUX, W. S. STONE, G. F. GORDON, E. B. YOUNG, and E. U. LINDSAY.

National City, Cal.—W. G. DICKINSON, General Manager of the San Diego Land & Town Co., informs us that 3 miles of 6, 8, and 12-in. pipe to irrigate 500 acres is being laid into the "Ex Mission" lands of San Diego.

Salt Lake City, Utah.—The question of an additional water supply is being actively discussed. The big spring at the head of the Big Cottonwood cañon has failed and the creek itself is rapidly drying up. Notices have been sent to consumers to use water sparingly. It is proposed to secure the services of an expert engineer and have the different plans that have been put forth thoroughly investigated.

The plan meeting with most favor is to build a series of very short dams up among the lakes around the source of the Big Cottonwood to form a reservoir with an area of 150 to 200 acres, and build a ditch to connect this reservoir with the city. The estimated cost of the work is $200,000. It is also stated that Pratt Bros. Co. have secured the two best additional sources of water supply, and are now proposing to double the present supply of water. M. F. STURGES is the engineer in charge of their work. They contemplate a total expenditure of about $150,000, and offer to supply the city with 5,000,000 galls. per day for $6,000 per year.

Springville, Utah.—Plans for the Big Hollow reservoir have been finished by the Engineer, M. T. STURGES, Salt Lake City. It will have a capacity of 200,000,000 galls. The dam is 48 ft. high. Cost, $11,000. If no better site can be found, they will endeavor to build this reservoir this fall.

Ogden, Utah.—The special committee appointed to report on the water question have reported in favor of accepting the proposition made by JOHN R. BOTHWELL for the Bear River Canal Co.

Ketchum, Idaho.—The following information is sent to us by JNO. CORKISH, Portland, Ore.:

The Ketchum Water Co. is to build water-works in this place, and has awarded the contract to JNO CORKISH, Portland, Oregon. Work was begun in April and will be completed Aug. 1. Capital stock, $15,000. The officers are: President, J. STEWART; Secretary, GEO. SNOW; Treasurer, NAT. BANK. The works were designed by J. J. LEWIS, and the contract for pipe and specials awarded to the Puget Sound Pipe Co., Olympia, W. T. Water will be conveyed by gravity from springs to a 100,000-gall. reservoir. Mains, wood, 8 to 4-in., 4 miles. Hydrants, Portland, 7. Valves, Kennedy. Pressure: Ordinary, 65 lbs. Fire, 65 lbs. Cost of works, $11,000. Debt, $2,500. Interest, 10%.

Canada.

Truro, N. S.—We are indebted to A. L. ARCHIBALD, Superintendent, for the following:

The extensions this year consist of 2,500 ft. of 6, and 300 ft. of 8-in. pipe, while 1,500 ft. of 10-in. pipe will be laid this year or next.

Montreal, P. Q.—The western abattoir is being generally changed, and arrangements are now being made with Mr. BERGEN, the water contractor for St. Cunegonde, to supply it with a proper water service.

Toronto, Ont.—WM. HAMILTON, Superintendent, has sent the following:

Contracts for extensions amounting to $577,587 have been let as follows:

Two 3,000,000-gall. pumping engines: 4,600 ft. of 48, and 6,000 of 60-in. steel conduit to convey water from the lake to the pump well; also extensions to the 36, 24, 12, and 6-in. cast-iron mains.

Napance, Ont.—The contract for building the water-works has been transferred from A. P. Northey, Toronto, to Messrs. Hanover, of New York City, and Hinds, of Watertown, N. Y. They are to be completed by Nov. 1.

Windsor, Ont.—The Water Commissioners have concluded their labors with Levallie & Co., and succeeded in making them cut their bill down $1,400, because of the quality of pipe they sent. The commissioners are determined that the water-works shall have an honorable record in regard to expenditures.

Brockville, Ont.—B. F. STEBEN, Manager, informs us that the Brockville Water Co. contemplate erecting a stand-pipe.

Winnipeg, Manitoba.—The following estimate has been made by the city engineer of apparatus necessary to supply Brookside cemetery with water: A 16-ft. windmill and pump complete, $410; a tank 14 x 12 ft. complete, 50 ft. high, on stone foundation, $910; 1,200 ft. of 2-in. pipe and filling, laid below frost depth, $600. The report was adopted with a few slight changes.

New Westminster, B. C.—We are indebted to ARTHUR HILL for the following information:

The town has voted to build water-works, and to purchase the franchise and rights of the Coquitlam Water Co., organized some time since, for $20,000. Debentures to the amount of $200,000 will be issued. The council is now considering the appointment of an engineer.

Calgary, N. W. Ter.—We are indebted to THOMAS C. KEEFER, Dalhousie, N. B., for the following information:

Negotiations are now pending between the town and the water and gas company, and it is expected that work in the water-works will begin soon. Plans have been prepared by THOMAS C. KEEFER, Dalhousie, N. B.